ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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What in the World!

$300,000,000 of America's billion-dollar lighting bill is wasted, according to speakers at the Conference on the Economics of Lighting at Case School last week. All because we don't wash lamps and reflectors, don't use brighter and better wall and ceiling surfaces and don't install properly designed reflectors. A good opportunity to get $300,000,000 of light with no increase in the energy bill (p. 210).

●

"It is easier to sell industry a $5,000 milling machine that will show a 10 per cent saving than to persuade it to buy a new tool for maintenance at $1,000 that will show a 200 per cent annual saving." That is Mr. Collins' way of saying that management does not think in terms of maintenance, but rather in terms of production, and that electric welding is being overlooked in many, many plants (p. 220).

●

Facts and figures are, like life itself, roughly, sometimes very roughly, what you make them. Our old friend the Bonbright Survey is fresh from the press once more and its facts and figures are as meaningful or meaningless as you may choose to make them. One study (p. 225) shows how the capital structure of the industry may be checked against investment values.

●

Rural line costs can be reduced, conclude Electric Bond & Share engineers after a comprehensive survey of the subject. Better planning, higher primary voltages, longer spans, poles which are only strong enough and less costly transformer accessories are seen as needed (p. 234).

Strip mining, Pittsburg, Kan.

FEBRUARY 18, 1933

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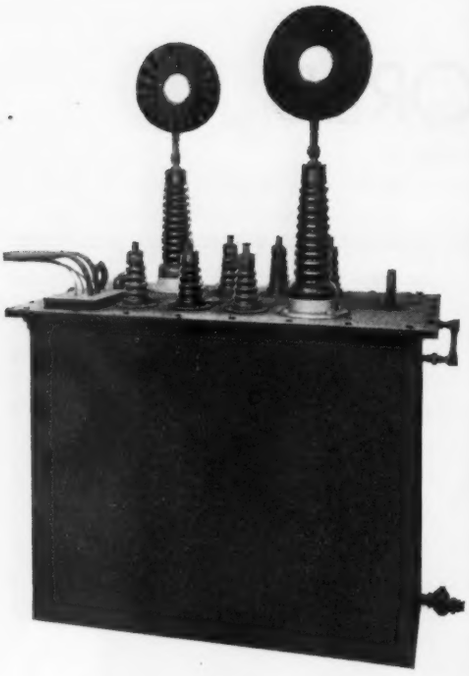
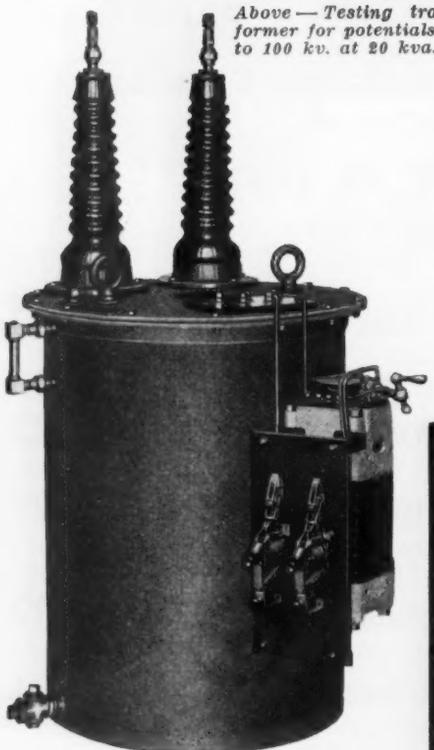
For more than thirty years American Transformer Company has specialized in the development and manufacture of every conceivable type of transformer equipment used for electrical testing. A few of the types most generally used for commercial testing are illustrated on this page but many other designs are available for testing specific products, such as oil, cable, and apparatus.

Literature describing the complete line of AmerTran Testing Transformers will be mailed promptly on request and our engineering department would welcome the opportunity of suggesting equipment to meet your specific requirements.

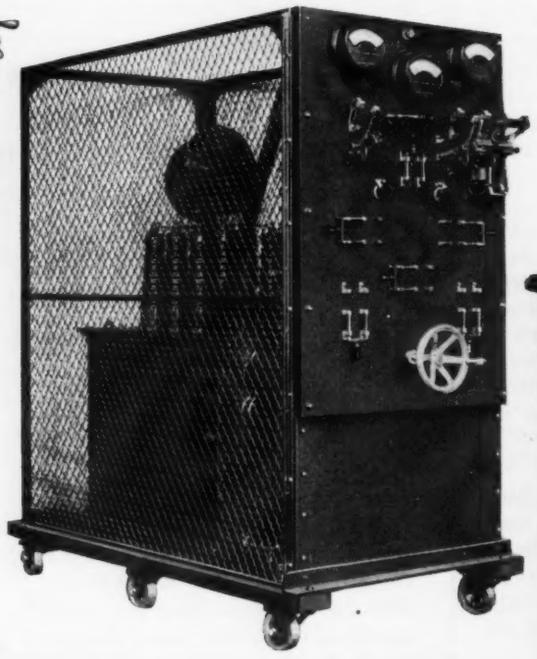


Above — Testing transformer for potentials up to 100 kv. at 20 kva.



Above—Testing transformer (with voltage regulator and circuit breaker) for potentials up to 50 kv. at 5 kva.

Right — Complete test set for potentials up to 100 kv. at 20 kva.



Below — Special testing transformers of this type are made for voltages from 100 to 300 kv. and in sizes from 5 to 300 kva.

The American Transformer Company

170 Emmet St., Newark, N. J., U. S. A.

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

February 18, 1933

N.E.L.A. Convention Votes Dissolution

NEARLY lost in the splendor and spaciousness of one of New York's grandest ballrooms, some one hundred members of the National Electric Light Association spent exactly thirty minutes on Wednesday, February 15, 1933, putting a comma to the half-century life of the association. It cannot exactly be called a period, because on the following day trustees met to plan the career of the new Edison Electric Institute, created, in the words of President Cortelyou, to carry on the "best work that has been done" by its predecessor.

Perfect unanimity and solemnity marked every stage of the proceedings, much of which hinged on the mechanism of dissolution and liquidation. A committee of five, consisting of Messrs. Cortelyou, Edward Reynolds, Jr., P. S. Young, T. A. Kenney and E. W. Lloyd, was given plenary powers to effect the liquidation during the remainder of the calendar year. Whatever residue is then available out of the book surplus of approximately $830,000 after providing for the present commitments and the wind-up of committee activities will be divided by the committee among class A. D and F members in proportion to the contributions made by them from January 1, 1926, to February 15, 1933.

Thus a movement which started in September in the direction of merging with the Association of Edison Electric Illuminating Companies, in part as an economy measure, was switched toward the complete abandonment of the N.E.L.A. for the sake of having a brand new set-up. The dominant reason was stated by President Cortelyou to be that "for a number of years there has been a feeling among the leaders of this industry, accentuated by the events of the past four years, that the industry should be so organized as to be able better to exercise a reasonable degree of self-discipline; in other words, to be endowed with certain authority with respect to the business practices of its members. This was not provided for in the constitution of the National Electric Light Association." The constitution of the new Edison Electric Institute has been framed with just this as its essence (ELECTRICAL WORLD, January 14, page 49).

President Cortelyou explains

In closing his remarks outlining the history of the dissolution program Mr. Cortelyou said:

"This association was organized just forty-eight years ago this month. The organization took place on February 25, 1885, at a convention called to meet in Chicago. At present its membership comprises, from the standpoint of output in electric energy, about 90 per cent of the electric light and power industry in the United States, representing a capital investment of over ten billion dollars. It also includes in its membership the electric light and power companies in Canada. Unquestionably, the association, through the work of its engineering committees, its commercial and accounting committees, its employee training and employee educational committees, its rate research, statistical and similar committees, under the general direction of my distinguished predecessors in office, has made enormous contributions toward advancing the art of generation, distribution and utilization of electricity not only in the United States but throughout the civilized world, for the reports of these committees have been eagerly studied wherever electric service is supplied.

It is the purpose of the Edison Electric Institute, in so far as prevailing business conditions and the urgent need for economy will permit, that these valuable services shall be continued. Electric service has assumed a large and vital rôle in the life of the nation, and this industry cannot stand still, but must keep abreast of the march of events. In the further advance of the art of producing, distributing and using electricity in the public service, without question, committee activities, facilitating interchange of information, will continue to play as important a part as they have heretofore, and I can assure you that under the Edison Electric Institute the best work that has been done by the National Electric Light Association will be carried forward."

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New Jersey Voltage Raised Without Telling Customers

Last June Public Service Electric & Gas Company raised the voltage of the energy supplied to general consumers from a nominal 115 to 117½. In September a second boost from 117½ to 120 volts was made. On February 10 of this year the newspapers brought this to public attention and the utility issued a statement. Newspapers raised the interesting point of whether it is better to face the possible protests of consumers and tell or to wait until presumably all, or virtually all, the lamps in service at the time of the change have been replaced. Advantages and disadvantages to the consumer are of course involved.

Public Service announces through Vice-President O'Toole that only 120 volt lamps have been sold by it since June but lamps purchased through other outlets by consumers who did not know of the change are something else again.

The company in making the announcement stated in part: "When 115-volt lamps are operated at 120 volts the remaining life of the lamp is decreased about 40 per cent; the amount of electricity consumed is increased about 7 per cent and the amount of light given is increased about 17 per cent.

Consultants Who Anticipate Increase Cincinnati Outlets

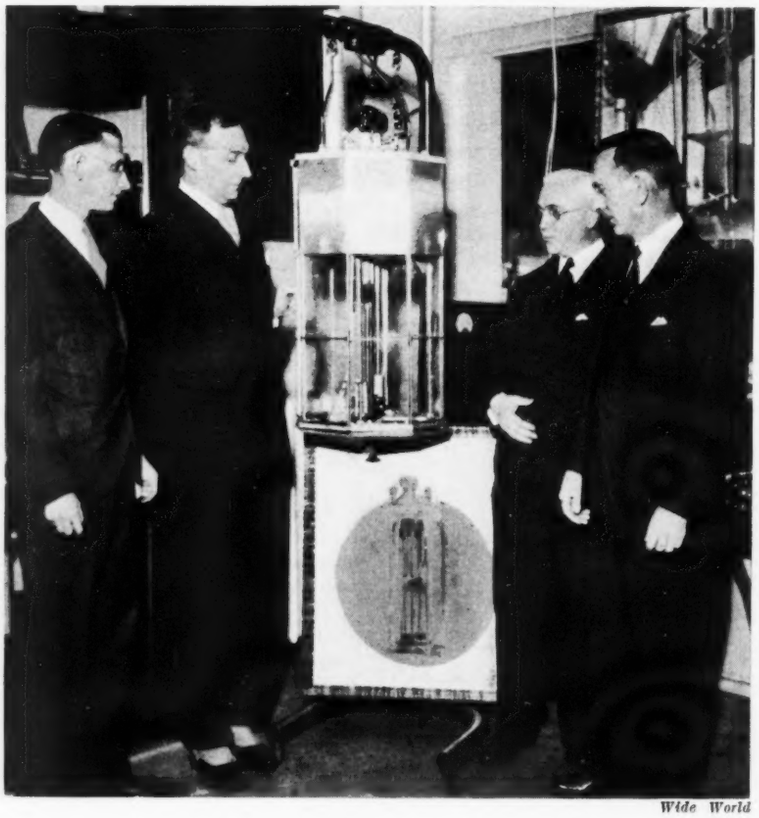
In 1932, 227 new homes in Cincinnati were planned to contain 8,596 electric outlets. When these homes were built they had 13,722 outlets, 5,126 more than originally specified. This increase was the work of three young women in the sales department of the Union Gas & Electric Company. They proceeded on the assumption that mere man has little conception of what conveniences a woman wants in a home and evidently they were right to the tune of nearly a 60 per cent increase in the number of outlets. Of course, they tried for more than this. They said there should be 14,432 outlets in these 227 homes, a 68 per cent increase, but they were beaten down to 60.

By watching reports and issuance of building permits and keeping eyes open generally, new home projects are spotted and contacts made immediately with architects, contractors and owners. In each case permission is asked to inspect the plans and to make recommendations for a sufficient number of outlets.

In consultation with the woman who is going to live in the house, if that is possible, furniture arrangements, habits of the prospective occupants and places where appliances may be used are gone over thoroughly. The results of these conferences are usually as indicated above; the future feminine occupant discovers that "those men" did not have the slightest idea of how many electric outlets she wanted nor where she wanted them. In the year that this advisory service has been offered by the utility, architects and contractors have learned its value and now avail themselves of it freely. Also, to a large extent, the public has been educated so that more and more frequently now the utility is asked to look over plans for new homes.

▼

Three Hundred Millions Wasted?



Wide World

One-third of the nation's billion-dollar lighting bill could be saved with soap and water, light-colored walls and proper reflectors, those attending the Conference on Economics of Lighting at the Case School of Applied Science in Cleveland last week were told. Here are A. A. Brainerd, Illuminating Engineer Philadelphia Electric Company; J. W. Barker, dean of engineering at Columbia University and president of the Illuminating Engineering Society; President W. E. Wickenden of the Case School, and L. W. W. Morrow, editor of ELECTRICAL WORLD, examining one of the exhibits at Case, a high-power ultraviolet lamp of the double arc type.

Case Lighting Conference Discusses Economics

Economics of applied lighting furnished the theme of a conference at the Case School of Applied Science last week. Some 250 were in attendance and an unusually good program was presented. W. D. Kiefer, National Safety Council, showed that roughly $1,500,000,000 resulted from accidents each year in industry. If 15 per cent of these accidents were reduced by good lighting there would be an annual saving of $235,000,000.

That, at the present, insufficient street lighting causes an annual loss of some $200,000,000 because of accidents, or more than the per capita cost of the lighting was pointed out by L. A. S. Wood, of Westinghouse, who demonstrated that despite an enormous increase in traffic street-lighting expenditures had not increased proportionately and cited data to show the fallacy in reducing street-lighting expenditures. Ward Harrison, of General Electric, discussed lighting as an aid to industrial production and showed that lighting expenditures were a small part of total production cost. F. J. Pearson, Chicago Merchandise Mart, discussed the relation of lighting to merchandising and showed how merchants used light to sell. A. A. Brainerd, of Philadelphia Electric, cited data, where lighting is applied to exteriors and show windows, to show the commercial gains resulting from this use of light. W. E. Malm, president Building Owners and Managers' Association, gave a splendid paper on the value of good lighting from the point of view of an office building owner and manager and pleaded for better automatic control of artificial light in buildings.

S. G. Hibben, of Westinghouse, referred to maintenance and maintenance costs to show that the final economic results of lighting depended upon proper attention to this element. E. A. Brand, of Niagara Hudson, discussed wiring as a part of the economics of lighting and urged a greater adequacy than called for in the National Electrical Code. Other papers were presented by L. V. James, of General Electric; J. W. Barker, president of the Illuminating Engineering Society; Walter Sturrock, of General Electric; A. H. Tashjian, architect, and L. W. W. Morrow, editor of ELECTRICAL WORLD.

This conference was restricted to the economic aspects of electric lighting and the papers as a whole contained the latest data and information on lighting costs and returns. Good discussions were forthcoming and a vote of thanks was given to the officials of Case who arranged the conference. Abstracts of several papers will be presented in early issues of ELECTRICAL WORLD.

Samuel Insull, Jr., Testifies; Father Too Poor to Return

Unrealized, and today wholly non-existent, paper profits of $25,000,000 through a contract enabling members of the Insull family to buy stock in Insull Utility Investments, Inc., at a price far below the market quotation, was the most sensational element to develop during the examination of Samuel Insull, Jr., by the Senate banking and currency committee this week. Mr. Insull stated that his own allotment of 29,640 shares of Insull Utility Investments was purchased by him at 15 when the market was 65. By an exchange of securities a portion of this was sold by him to the Corporation Securities Company for 40.

Assailed by Senator Norbeck, chairman of the Senate committee, Mr. Insull maintained that he had held the stock instead of taking any profit, electing "to sink with the ship."

Yields as P. G. L. & C. director

In the annual report of Peoples Gas Light & Coke Company issued this week announcement is made of the resignation of Samuel Insull, Jr., as a director, a member of the executive committee and as vice-chairman, thus creating the fourth vacancy on the board. It is expected that these positions will be filled at the annual meeting of stockholders on February 28. Mr. Insull has been made assistant to the chairman of the company. James Simpson, chairman of the company, in a foreword to the report, declared that the company had definitely abandoned the practice of buying its own stock in the open market through its investment subsidiary.

Samuel Insull's stand on returning to this country remains unchanged. In a recent statement he is credited with saying: "My mail from America confirms me in thinking I should have nothing to say in my own defense. I can't give my opinions in whole in this matter without making more enemies for myself, and I won't give them in part. The whole case will have to rest just where it is . . . I cannot discuss my own affairs while I am in a position where I am not able to act of my own volition. Why, I couldn't even afford to live in the United States on my present income."

Mississippi Valley charges

In a report filed last week in the federal District Court, Chicago, Eugene V. R. Thayer, receiver, charged that the treasury of the Mississippi Valley Utilities Investment Company was looted and its preferred-stock holders and creditors were defrauded by its parent company, the Middle West Utilities Company. Maintaining that the investment funds of the company, raised by the sale of securities to the public, were so manipulated as to benefit the parent company at the expense of the subsidiary, he recommended rejection of a claim filed by Middle West against Mississippi Valley for $21,442,000 as a loan and accrued interest.

In the meantime at Federal Trade hearings in Washington testimony was presented to show that the Mississippi Valley company paid dividends at virtually the full quarterly rate shortly before it went into receivership last year, when, allegedly, it must have been evident to the management that the company was in grave financial condition. J. W. Adams, a commission examiner, said that the book value of investments was $48,896,863, but that the realizable value was approximately $5,658,000.

Cleaning Up Is Dirty Business

America may be nearer the end of its troubles and closer to the resumption of better times than most of us are even daring to hope. For the next few months the mopping-up process under which the unpleasant residue of adjustments already made and the precipitation of adjustments still to be effected is likely to be emphasized. The troubles in Michigan, bringing a gubernatorial eight-day moratorium, is an example. Spectacular though such developments are, they may be seen, without senseless optimism, as but the clearing of the storm.

Essentially, the program of the incoming administration is sound. If Mr. Roosevelt can persuade the new Congress to work with him or deliver to him the necessary emergency power, much can be accomplished. The administration, if for the moment the mad-house that is Congress be overlooked, is committed to a program of reduced governmental expenditures, a balanced budget, sound currency, reciprocal tariff agreements and other measures to restore international trade.

Congress, for political reasons, may not be able to agree on economies, on war debts or the bonus, but it can, without "losing face," grant certain powers and approve various agreements that Mr. Roosevelt might effect. Even approximations of the program would help to restore confidence.

When the patient has passed the crisis there are still anxious days of watching and waiting; there are relapses which seem of the gravest nature. America may have passed the crisis of its economic illness; only time can demonstrate.

Figures of the week show little change. Energy production increased following the bad weather of last week. Most price indexes varied in narrow ranges. Volumes just about held their own.

Associated Gas & Electric Pays Interest in Script

Holders of the 5, 5½, 6½ and 7 per cent convertible obligations, series A, of the Associated Gas & Electric Company have received five-year 7 per cent scrip in payment of the February 15 interest. Previous payments have always been in cash. Interest on the scrip is payable in cash on maturity, according to the statement of the company.

"Preliminary figures for the twelve months just ended are sufficient to meet interest charges on all of the interest bearing securities outstanding, including the convertible debentures," the company's statement said. "However, on account of the present business depression the directors feel that it will be to the best interest of the company and its security holders to conserve the company's cash resources."

Utility Parallels Seen in Rail Survey Report

In the report of the National Transportation Committee, issued this week, a number of recommendations are made which have to do with more or less obvious parallels in the electric utility industry. This committee was organized in October of last year at the behest of savings banks, insurance companies, etc., under the chairmanship of the late Calvin Coolidge to investigate the conditions of the railroads and transportation industry generally.

Briefly abstracted, some of the recommendations were: "Changed conditions require new policies but not abandonment of railroad regulation; regulation should not attempt to 'run the business'; certain regulation of competitive methods is necessary, they cannot be permitted to escape their just tax burdens; permanent and universal liquidation and downward adjustment of values and incomes have occurred in this country and railroad rates, capital structures, salaries and wages must all respond to this generally changed condition; we see no reason why the rate-making rule should not say in plain English that railroads are entitled to make a reasonable profit based upon costs of efficient operation and that they are not entitled to earnings merely to preserve present structures if overcapitalized; we distinctly do not believe that past mistakes as represented by present unwieldy debt structures should be salvaged by increased rates. The present debt structure must be revised and losses written off.

"Wherever there is fair economic competition," emphasized the report, "it will decide the rate question and it should be permitted to do so freely."

Coming Meetings

National Accounting Section, N.E.L.A.—Committee meetings. Chicago, Feb. 20-21. A. J. Marshall, 420 Lexington Ave., New York.

New England Division, N.E.L.A.—Engineering Section, Boston, Mass., March 2-3. O. A. Bursiel, 20 Providence St., Boston.

Oklahoma Utilities Association—Oklahoma City, Okla., March 7-8. E. F. McKay, 1020 Petroleum Bldg., Oklahoma City, Okla.

National Sales Section, N.E.L.A.—Committee meetings, Chicago, March 21-23. A. J. Marshall, 420 Lexington Ave., New York.

National Engineering Section, N.E.L.A.—Committee meeting, Detroit, Mich., April 10-14. A. J. Marshall, 420 Lexington Ave., New York.

Maryland Utilities Association—Baltimore, Md., April 21. D. E. Kinnear, 803 Court Square Bldg., Baltimore, Md.

Missouri Association of Public Utilities—Excelsior Springs, Mo., April 27-29. N. R. Leagle, 101 West High Street, Jefferson City, Mo.

N.E.L.A. Meetings subject to action of dissolution convention.

New Edison Foundation to Establish Memorials

Although not yet incorporated, an International Edison Foundation has been agreed upon by the Edison Pioneers and the American Institute of Electrical Engineers to erect memorials to the late Thomas A. Edison and to establish fellowships in his name in physics and chemistry in the leading universities of the United States and other countries.

According to William S. Barstow, president of the Edison Pioneers, who made this announcement at the fifteenth annual meeting of that organization, the details of the plan will not be available for some time, but the essential basis for the joint foundation has been reached.

Notable among the tangible memorials planned for Mr. Edison at present is permanent financial support for the eternal light at Menlo Park, N. J., where Mr. Edison had his first large laboratory. Another projected memorial is being discussed for Eagle Rock, overlooking the Edison home and laboratories at West Orange, N. J.

International fellowships

Tentative plans for the fellowships, under which American graduate students will be sent abroad and foreign students will be brought to this country to continue their education in basic and applied physics and chemistry, were described by Arthur E. Kennelly, professor emeritus of electrical engineering at Harvard University and the Massachusetts Institute of Technology, who was associated with Mr. Edison for six years in his laboratory in West Orange, N. J.

Mr. Kennelly is chairman of a committee of three appointed to confer on the fellowships. The others are Prof. Charles F. Scott of Yale and Dr. Clayton H. Sharp, president of the United States national committee of the International Electrotechnical Commission.

Regulation of Rates Sought for Federal Power Commission

Approval of the Shallenberger bill to amend the federal water-power act to enable the Federal Power Commission to regulate rates for electricity so as to prevent discrimination as between communities was urged last week at a hearing before the House committee on interstate and foreign commerce. The bill applies to companies doing an interstate business or operating under a Federal Power Commission license.

Under the bill the Power Commission would be empowered to enforce a requirement that a power company might not sell current at a lower rate in one community than another unless there is a difference in cost between the two communities, and where there is a difference in cost the difference in rates must be in proportion. The commission would have authority to take action on complaint of an aggrieved party or its own initiative, and to prescribe rates which in its judgment would eliminate discrimination.

Allison Williams, consulting engineer of Yazoo City, Miss., and W. V. N. Powelson, consulting engineer of New York City, appeared in favor of the bill, while George Otis Smith, chairman of the Federal Power Commission, told the committee the commission favors the purposes of the bill, although it has not passed on the specific terms.

New Englanders Push Domestic Load Building

Heartening reports of progress in domestic load building featured a largely attended meeting of the sales section, New England division, N.E.L.A., on Monday of last week at Boston. L. F. Eaton, chairman of the water heating committee, stated that a recent survey showed more than 5,000 storage water heaters to be in use in New England, 1,100 having been added in 1932. These represent an annual revenue of about $250,000. Studies by individual companies indicate that energy rates above 1.5 cents per kilowatt-hour do not attract volume business and that a total cost of $4 to $5 per month represents a satisfactory price per family for this class of service.

The 1933 outlook for both heaters and electric ranges is excellent in this territory. L. H. Knapp stated that 625 off-peak water heaters in service on the Hartford Electric Light Company system consume more than 300,000 kw.-hr. between 11 p.m. and 7 a.m. in total yearly service and that rental greatly accelerates the use of heavy-duty household appliances. Heaters are now sold on a seven-year budget plan to compete with gas-fired equipment. The off-peak energy rate of 1 cent per kilowatt-hour is sharply competitive with 80-cent gas.

Legislators Consider More Utility Law Suggestions

Further suggestions in the form of bills to effect utility legislation are being presented to the state lawmakers now in session. In addition to those previously reported (ELECTRICAL WORLD, February 4, page 180) the following may or may not receive attention and enactment as the vagaries of fate may ordain.

KANSAS—Would abolish all service charges. Would reduce penalty for failure to pay monthly bills promptly. Would revise law relative to paying cost of construction of rural service lines.

MISSOURI—Would prohibit utility appliance selling. Would prohibit penalties on customers for failing to pay bills on a designated date. Would fine company for overcharging customers with fast meters. Would require two-thirds vote instead of a majority for granting franchise. Would merge three state bureaus with Public Service Commission.

NEBRASKA—Would bar discrimination in sale of electric power between communities, allowing for differences in cost of furnishing electricity. Would create board of commissioners to supervise electrical installations and licensing of electricians. Would restrict right of way for electric transmission lines, authorizing condemnation by rural electric districts, corporations or municipalities. Would impose 1 per cent sales tax where electricity is furnished to consumers for industrial purposes and 2 per cent tax where electricity is furnished for other purposes.

NEW YORK—Would amend public service law for inspection and testing of electric meters and relative to charges for unmetered electricity. Would prohibit discrimination in employment on account of race or color. Would repeal section of penal law relating to interference with electric, gas meters or steam valves. Would prohibit discrimination in furnishing electric service to different communities, allowing for differences in cost of furnishing service.

OREGON—Would create hydro-electric commission to promote development by state of hydro-electric power. Would create state power commission for development, transmission and sale of power by state.

New York Commission Seeks Wider Powers

Seeking to bar a type of financing which it alleges has been greatly discredited since 1929, the New York Public Service Commission in its annual report asks a wider control of holding companies. The commission would prohibit public utility operating companies from using their credit to finance holding companies or affiliated operating units except possibly with commission approval.

Legislation is also asked to bar operating companies from using their revenues for any other purpose than operation, maintenance, depreciation costs and the extension of facilities and services, as well as the payment of fixed charges and dividends to stockholders.

It is now common knowledge, the report declares, that "the greatly exaggerated claims of the financial superiority of holding companies were myths," experience having shown that the pyramiding of security issues resulting from acquisition by the holding company of operating securities at high prices was an element of weakness. The result of such organization, the report asserts, is that the holding company is unable, in times of stringency and tight money markets, to obtain funds as readily as the operating utility whose stock it holds.

"The underlying operating companies," the commission reports, "now must depend upon their own resources to raise capital, and they can do it on much more favorable terms than the holding companies. Companies that hold only securities and own no operating properties find it practically impossible to obtain funds and the market value of their securities has descended to depths of which no investor dreamed when he was enticed by rosy prospectuses and promises of great earnings to pass by the securities of operating utilities and invest in the securities of holding companies."

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Trade Commission Budget Gains by Senate-House Shift

Convinced that the public utility inquiry of the Federal Trade Commission should be continued, the Senate appropriations committee last week increased the $510,000 which the House voted the commission for the coming fiscal year to $790,000, stipulating that the $280,000 should be available for completing the utility probe. The action was recommended to the full committee by a sub-committee after Senators Walsh, Norris and Nye, together with commission spokesmen, had said that if the commission were limited to the fund voted by the House, the utilities inquiry would be halted where it stood. At the hearings before the Senate Senator Walsh presented a letter from Robert E. Healy, chief counsel of the commission, in which Mr. Healy stated that the results of the investigation had been so far-reaching that the electrical utility industry was making reforms and had announced a program which if carried out in good faith will save the people of the United States hundreds of millions of dollars. He maintained that lack of funds now would mean halting the work at a crucial stage.

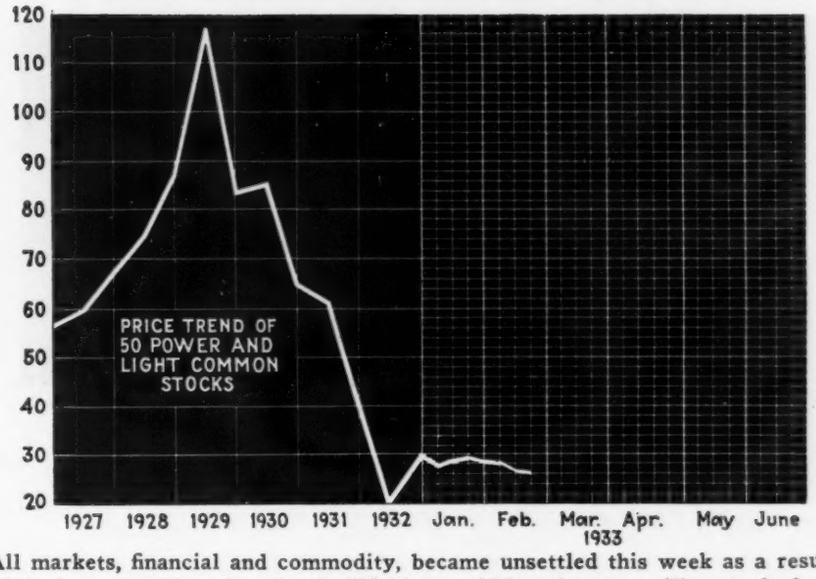
House favored budget cut

It was not without a flutter of protest that the House of Representatives the preceding week drastically reduced the budget of the commission by $590,000.

Representative Cochran of St. Louis told the House that he could not understand why the committee on appropriations asked the House to cripple the only government commission which serves to protect the mass of people. "Year after year," he said, "certain interests have come here asking us to cut off this appropriation. It is absolutely vital that the commission would not be able to prepare a report covering its findings, and years of investigation by hundreds of trained experts will be lost. I consider it especially important that the commission be permitted to continue its investigation of the methods which resulted in the Insull scandal."

Mr. Cochran was supported in his claims by Representative La Guardia of New York City and Representative Rayburn of Bonham, Tex., chairman of the committee on interstate commerce.

Stock Market Under Pressure



All markets, financial and commodity, became unsettled this week as a result of the tense banking situation in Michigan. Although some utility stocks held firm, declines in some of the leaders ranged from one to three points, the "Electrical World" index receding to 26.0, as compared with 27.0 in the preceding week.

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Louisville Gas and Electric Faces Fourth Tax Suit

Sheriff Hubbard R. Petty has filed against the Louisville Gas & Electric Company (Delaware) the fourth of an indeterminant number of suits for unpaid taxes. The last previous one was in the fall (ELECTRICAL WORLD, September 10, 1932, page 324).

Suing on behalf of the state and county, the sheriff asks that assessment be made on certain intangible property of the company and asks that taxes be paid on the property for the period from July 1, 1922, to July 1, 1932. In addition to the taxes the 100 per cent penalty due the state, plus 6 per cent interest on the taxes, plus the 20 per cent penalty due the sheriff plus costs is asked.

Property in question constitutes securities of various companies and accounts receivable estimated by the sheriff to have a "fair cash value" of $36,150,000.

Of the three suits already pending against the company the first, filed against the Kentucky Coke Company, asks for the assessment of the defendant's franchise, valued at $30,000,000, for ten years. The second suit, against the Kentucky Coke Company, makes similar claims. The third, filed against the Louisville Hydro-Electric Company, seeks to collect taxes on a valuation of $30,000,000 for the company's franchise for a period of five years.

Since last December Judge Henry I. Fox has had under submission a motion made by attorneys for the defendants to consolidate the suits.

Industrial Pick-up—or Storm?

Contrary to the usual downward trend at this time of the year, output of electric light and power plants during the week ended February 11 rose so sharply as to neutralize the losses of the two preceding weeks. Energy generated amounted to 1,482,509,000 kw.-hr., or 2 per cent more than in the week of February 4, according to the National Electric Light Association, and approached within 6.1 per cent of production a year ago. Excepting a very slightly better showing around the holiday period it is necessary to go back exactly twelve months to find an equally small disparity.

Unfortunately for purposes of comparison, last week was marked by almost country-wide snowstorms and abnormally cold weather, hence no valid conclusions can be drawn as to industrial changes. The Pacific Coast region alone failed to register a pronounced relative rise.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1933	1932	1931	1930
February 11	1,483	1,579	1,684	1,770
February 4	1,455	1,589	1,679	1,782
January 28	1,470	1,589	1,687	1,809
January 21	1,484	1,598	1,713	1,826
January 14	1,495	1,602	1,717	1,834

Per Cent Change from Previous Years

Region	Week Ended Feb. 11	Feb. 4	Jan. 28
Atlantic Seaboard	— 4.2	— 7.8	— 6.5
New England alone	— 5.7	— 8.1	— 6.8
Central industrial	— 6.5	—11.0	—10.9
Pacific Coast	— 8.4	— 8.8	— 5.2
United States	— 6.1	— 8.4	— 7.5

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Canada Has 1,105,770 Kw. in Electric Steam Boilers

One hundred and twenty-six electric steam generators totaling 1,105,770 kw. have been installed in Canada, according to B. A. Malkin, chief engineer paper machinery department, Dominion Engineering Works. These do not include boilers of less than 50 kw., of which a large number have been installed, chiefly for laundries and heating office buildings and houses. The largest users are paper mills with 822,300 kw. Fifty-eight units totaling more than 808,000 kw. are in Quebec (the Shawinigan Water & Power Company has 24 totaling nearly 335,000 kw. alone) and 24 totaling nearly 175,000 kw. are in Ontario.

Up to the present time where no fuel-fired boilers are installed in parallel with the electric boilers it has been considered necessary to provide a steam accumulator to take care of excessive variations in steam demands. The maximum voltage and rating so far installed are 13,200 volts and 42,000 kw. respectively. Although automatic controls have been developed and installed, practically all the large units are manually operated because the law demands a steam engineer in attendance.

Availability of surplus hydro power at low rates has been largely responsible for this development in Canada—the surplus being seasonal, off-peak, week-end or due to industrial depression or too rapid hydro-electric expansion. To compete with fuel at $10 per ton on a steam-cost basis alone, power has to be available at no more than 2 mills per kilowatt-hour. However, several advantages would offset a higher ratio of power to fuel cost, reports Mr. Malkin, namely, low first cost, cleanliness, small space, flexibility of location, no fuel storage or ash disposal and ability to start quickly. Some companies are using electric boilers to make better utilization of their demand charges.

Special plans lend inducement

By far the most interesting development is the use of electric steam generators by power companies to sell unused power. The power may be sold as secondary power at low rates, but some companies consider this inadvisable, and Mr. Malkin reports that a scheme has been devised whereby the utilities sell steam to the consumer at a little less than the cost of producing it by coal. In some cases the power company owns the boiler and contracts with the consumer to operate it and use such power as is available. The power company reserves the right to withdraw power at any time provided it gives the consumer sufficient notice to bring his steam-fired plant up to capacity.

In one 60,000-kw. installation operated on this basis about 200,000,000 kw.-hr. was used in 1930, representing a revenue of $160,000 annually for otherwise unsalable power. The load factor was 30 per cent. One large Quebec company produced nearly 2,750,000 lb. of steam in 1929 and 1930 electrically.

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Developed Water Power Now One-fifth of Resources

Total capacity of water-power plants in the United States on January 1, 1933, according to the annual report just released by the Department of the Interior through the Geological Survey, was 15,817,941 hp., an increase during the year of 255,000 hp., or 1.6 per cent.

The states showing an increase of more than 10,000 hp. during the year are Pennsylvania, 86,000; Michigan, 30,000; Texas, 16,000; Washington, 42,000, and California, 40,000.

It is estimated that water wheels with a capacity of about 80,000,000 hp. would be required to make use of all the water power in the United States. Less than 20 per cent of the nation's water-power resources, therefore, is developed at the present time.

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Britain's Grid Project Virtually Completed

Lacking but 223 miles of overhead construction to bring to completion the great national grid scheme which has for several years been under way to bring to Great Britain the advantages of an integrated and interconnected system of transmission lines, the British grid scheme is virtually completed. In 1932 there were constructed 1,360 miles of overhead lines. The total grid mileage as the year closed was 3,768. About £23,998,000 or, at par, $120,000,000, was expended on the grid in 1932.

Most interesting of the engineering elements constructed in the past year were the Thames crossing towers, by far the largest and highest in England.

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Pennsylvania Electrification

All through trains on the Pennsylvania Railroad between New York, Philadelphia, Baltimore and Washington now operate under electric power as far south as Wilmington, Del.

St. Lawrence Agreement Reported to Committee

Members of the New York Power Authority having reached an agreement with representative army engineers as to the cost to be allocated to New York State for development of the St. Lawrence power project, a Senate subcommittee has favorably reported the treaty to the full Senate foreign relations committee, with the recommendation that New York state pay $89,726,000 as its share. Previous reports had fixed New York costs between $100,000 and $150,000. The decision of the subcommittee followed testimony by Brig. Gen. George D. Pillsbury, assistant to the chief of army engineers, and Delos M. Cosgrove, vice-chairman of the New York Power Authority, who pleaded their case in Washington after Frank P. Walsh, chairman of the New York State Power Authority, obtained the approval of Governor Lehman.

Legislation to take care of the division of costs must be approved by Congress and the New York Legislature after the treaty has been ratified by the United States and Canada.

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Induction Heating Applied to Liquids and Gases

Induction heating, for some years successfully applied to magnetic materials on a commercial scale and more recently to non-magnetic solids, has been developed in Germany to the point where liquids and gases may be raised in temperature as may be desired by this form of electrical energy application.

Practical installation has been made, according to a recent issue of *Elektrotechnische Zeitschrift*, as at a Hamburg plant where vegetable oils are treated. Here oil is incrementally heated from 180 deg. C. to 240 deg. C. by pumping through two 100-kw. induction heaters. Circulation is accomplished at the rate of 5,280 gal. an hour, corresponding to a velocity of 6.5 ft. a second. The maximum temperature of the oil is 300 deg. C. and that of the induction tubes 335 deg. C. If resistance-wound tubes were used it is said that for the same temperature gradient about four times the tube surface would be required.

Advantages of the induction heater are reported to be: Direct application to the source of high-voltage supply with heating elements isolated from the supply, fluid heated by direct conduction without intermediate transmission, no local overheating of the charge and, as only a small amount of heat is stored in the tubes, the apparatus responds almost immediately to control.

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Would Bar Commission in Brooklyn Labor Row

Further protesting the right and propriety of the New York Public Service Commission's acting in the labor difficulties and disputes of the Brooklyn Edison Company (ELECTRICAL WORLD, January 28, page 114), that utility has, through counsel, asked that the complaint now before the commission be dismissed. Counsel for the thirty customers who filed the complaint argued that the state law could be interpreted to give the commission jurisdiction on the grounds that the adequacy and continuity of service had been impaired, citing an alleged increase in power house accidents of 100 per cent in 1931 after 2,300 employees of various classes were discharged. The complaint is the first one on labor policies ever to receive formal consideration from the commission.

"The courts have ruled," said Chairman Maltbie, "that the commission has no jurisdiction except that which is expressly conferred. I recall very well when the law was adopted in 1907 the opposition to giving the commission jurisdiction over any labor question."

C. B. Garver, representing the company, maintained that: "If the commission has the right or the duty to direct just how many employees shall be on the payroll of every public service corporation and the reasons for every discharge or laying off of an employee and the adequacy of the compensation paid to each, there is no detail of the business which is outside its duty to investigate and supervise. The approval of the commission would have to be obtained for the purchase of every ton of coal and for every detail of minute expenditure."

After hearing the arguments of these and several other interested parties, Milo R. Maltbie, chairman of the commission, closed the hearing on jurisdiction and directed that additional briefs be filed.

Major New Construction This Week

Surveys and plans authorized by Genoa-Columbus Loup River Development Commission, Columbus, Neb., for hydro-electric generating plant in connection with power canal from Loup River, including steel tower transmission line, substations, etc. Cost about $2,500,000.

Motors, controls, panelboards, wiring, conveyors, etc., will be installed by National Oil Products Company, Harrison, N. J. Estimated cost over $150,000.

Paragould, Ark., plans city-owned electric light and power plant. Fund of $100,000 authorized.

Heavy-duty motors, machine drives, transformers, pumps, loaders and conveyors will be purchased by American Potash & Super-Phosphate Corporation, New Orleans, La., recently organized, for plant near city. Cost about $100,000.

Bureau of Power and Light, Los Angeles, Calif., will purchase about 8,585,000 lineal feet of cable for 275,000-volt transmission line from city to Hoover Dam. Also, quantity of cable for 33,000-volt lines in city limits, transformers, switching equipment and complete auxiliary apparatus.

New York Refrigerator Sales Up

Reporting upon the sale of electric household refrigerator units in 1932 the Electric Refrigeration Bureau of the National Electric Light Association shows that in New York state 186,536 units were sold, against 185,226 units in 1931. This represents sales of 21.2 per cent over the quota set for the year by the bureau in its national sales campaign.

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Delinquent Electrical Accounts

(National Electrical Credit Association)

Number of Accounts Reported

Division	January 1932	January 1933	Per Cent Inc. or Dec.	Twelve Months 1931–32	Twelve Months 1932–33	Per Cent Inc. or Dec.
New York	220	174	—20.9	2,809	2,746	— 2.2
Middle and Southern Atlantic	127	83	—34.6	1,390	1,145	—17.6
New England	103	62	—39.8	1,140	1,151	— 0.10
Central	488	314	—35.7	6,481	4,909	—24.3
Total	938	633	—32.5	11,820	9,951	—15.8

Total Amounts Reported

New York	$20,392	$11,181	—45.1	$339,671	$235,181	—30.2
Middle and Southern Atlantic	14,195	4,721	—66.7	173,378	90,796	—47.6
New England	6,508	3,071	—52.8	93,763	85,082	— 9.3
Central	41,727	21,856	—47.6	574,227	332,712	—42.00
Total	$82,820	$40,829	—50.7	$1,181,039	$743,771	—37.0

New York Metal Prices

	Feb. 7, 1933 Cents per Pound	Feb. 14, 1933 Cents per Pound
Copper, electrolytic	5.00	5.00
Lead, Am. S. & R. price	3.00	3.00
Antimony	5.80	5.75
Nickel ingot	35.00	35.00
Zinc, spot	3.15	3.00
Tin, Straits	23.65	23.70
Aluminum, 99 per cent.	23.30	23.30

Writ Granted in Appalachian Case

A writ of certiorari has been granted the Commonwealth of Virginia and the State Corporation Commission in the tax case of the Appalachian Electric Power Company, the Supreme Court of Appeals, from whose decision the appeal is being taken, has been informed. The case involves $37,701 in taxes on bonds of a subsidiary of the corporation held outside the state. The matter will now be decided by the federal tribunal.

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Pasadena Surplus for Relief

Voters of Pasadena, Calif., at a special election authorized the appropriation of $200,000 from the surplus funds of the municipal light and power department to be used for relief of unemployment. The vote was 14,244 for the transfer and 2,678 against. The relief fund will be administered by a committee of city officials.

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Light Traps Save Fruit

Based upon several years' experience in New York state orchards it is reported by D. L. Collins of the New York Agricultural Station at Geneva that crops from lighted trees, whether sprayed or unsprayed, are 30 to 40 per cent better as regards the proportion of apples spoiled or worm-holed than the product of unlighted trees. "Lighting" is that offered when incandescent lamps are hung on or near trees to attract insect pests to traps and destruction.

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Manufacturers Co-operate for Sales

Under the sponsorship of the Electrical Association of New York a program of co-ordinated sales effort involving manufacturers, distributors and dealers of electrical appliances has been undertaken. More than 300 representatives of the interested parties met recently to discuss methods of increasing sales. One activity planned is the offering of monthly specialties upon which sales and promotional effort will be concentrated. February is table appliance month.

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Kansas Merchandising Ban Upheld

After a lengthy debate the Kansas state Senate in committee of the whole last week killed a bill which would repeal the law enacted two years ago prohibiting the sale of merchandise by utility companies. The measure has not yet reached the floor of the House. The Doherty units in Kansas some time ago obtained in the district court of Shawnee County an injunction forbidding the state to interfere with their sale of merchandise and since that time the companies have sold merchandise where they saw fit. The case is in the Supreme Court on appeal by the state. Other Kansas utilities have compiled with the ban.

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Better Tests for Wire and Tubing

By means of a new vacuum tube oscillator which has already been found of great value in the manufacture of General Electric products where the visual detection of small defects is but a slow process, requiring extreme care, and is often entirely inadequate, it is possible to detect flaws or cracks in tungsten, molybdenum or copper. Flaws are detected by means of eddy currents induced in the material inspected.

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I visualize the possibility of lighting arterial roads with these lamps, and automobiles will be able to speed along at night without the necessity of headlights. These lamps, using only 30 per cent as much energy as present lamps, will probably lend themselves first to street lighting, owing to their brilliance and efficiency.

SIR HUGO HIRST,
Chairman
General Electric Company, Ltd.

[**Sir Hugo, enchanted by the success of the trial installations of the new sodium vapor lamp near his company's works at Wembley, England (*Electrical World*, November 26, 1932, page 713), looks forward to not-far-distant-nights when highways may be truly lighted and not star-spotted.**]

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Italian Output Rises

Electrical energy production and use in Italy during the first ten months of 1932 totaled 8,396,796,000 kw.-hr., as compared with 8,388,916,000 in the same period of 1931. Output is largely hydro-generated, being for the ten months of last year 8,020,819,000 kw.-hr. from water power and 237,916,000 kw.-hr. from steam plants. Balance imported.

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Galloway Tunnel Completed

Driving of the 20,000-ft. tunnel which is to bring water to the great Galloway hydro-electric project in Scotland has been completed. The 11.5-ft. in diameter, concrete-lined bore to supply the Glenlee power station has been rushed to completion under 24-hour-a-day construction. Work commenced in September of last year.

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Potomac Electric Reduction

Both the Public Utilities Commission of the District of Columbia and officials of the Potomac Electric Power Company agreed this week to yield contentions for which they have held out and compromised upon a rate reduction by the utility to save electric consumers in the territory served about $562,000 this year.

Metropolitan Edison Hearing

Write-ups of more than $25,000,000 in a fixed capital account of approximately $85,000,000 were alleged in testimony before the Federal Trade Commission, hearing the status of the Metropolitan Edison Company as the operating subsidiary of Associated Gas & Electric Company in Pennsylvania. Against these write-ups, testified W. J. Warmack, there were write-downs of $442,236.

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A. T. & T. Earns Less Than Dividend

American Telephone & Telegraph Company, whose common stock is probably the foremost investment security of all junior issues, had to dig into surplus to pay dividends at the long-established $9 rate last year. Earnings in 1932 were $145,906,909, or $7.82 a share, against $166,666,534 in 1931, when $9.05 a share was earned.

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Merchandise Can Be Sold

From January 1 to 31 2,045 sun lamps and floor lamps for indirect lighting were sold by the Public Service Company of Northern Illinois. In the last three months of 1932 the company sold 1,100 such lamps just in its ordinary merchandising activity. The difference between 1,100 in three months and 2,045 in one month is the result of concentrated selling. Sales in January, 1933, were 15 per cent above January, 1932, in dollar volume and 132 per cent ahead in number of items sold.

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Los Angeles Power Line

Though a loan of $22,800,000 for the city of Los Angeles has been granted by the Reconstruction Finance Corporation and a total outlay for power facilities of $41,300,000 is planned in the next two years, it is estimated that at least three months will be required to get a decision from the California Supreme Court on the validity of the power department's certificates to the R.F.C. agreeing to repay the loan from power revenues.

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Shanghai Power Finances

Headed by the Hongkong & Shanghai Banking Corporation, a syndicate has underwritten 33,000,000 silver taels first mortgage 5½ per cent bonds of Shanghai Power Company, of which 15,000,000 silver taels was publicly offered in Shanghai at 96 and interest. The bonds run for 40 years and are payable in silver taels. Shanghai Power Company was organized by American & Foreign Power Company, Inc. This financing places the debt on the property on a long-term basis as compared with the present short-term maturity.

"Wax-Operated" Switches for Motored Appliances

As the result of an investigation undertaken in Great Britain to provide a simple piece of apparatus which would protect fractional horsepower motors and equipment, not ordinarily susceptible to safeguarding by the smallest practicable fuse of the replaceable type, a new form of "wax-operated" switch has been developed by the Indiarubber, Gutta Percha & Telegraph Works Co., Ltd., under the direction of A. G. Bullen.

For a fusing current of 3 amp. the cross sectional area of wire is of the order of 0.000018 sq.in. or the equivalent of No. 40 gage wire. One solution devised was to form wax into a strip or small diameter rod and then to deposit metal on it until the sectional area became 0.000018 sq.in. The deposited metal became electrically equivalent to No. 40 gage wire but mechanically dependent upon the wax. Since 3 amp. would be sufficient to fuse the metal coating at 2,000 deg. F. a much smaller current would cause a temperature rise sufficient to change the wax supporting the deposited metal; this change has been used to interrupt the circuit.

In the use of the principle for switch actuation, according to the *Electrical Review* (England), the most convenient form of conductor is a helical spring placed in a tubular container filled with wax. When the wax hardens the spring heating element is firmly embedded in it and makes a convenient thermal element in a form to restrain the movement of the switch mechanism. Switches are made with a catch mechanism attached to the wax thermal element. Under excess load the wax becomes less resistant to the convolutions of the spring heating coil until sufficient movement takes place and the switch trips. The inherent disposition of the heating coil is to return at once to its set position before the wax can cool and harden.

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Rectifier Protects Gas Main from Electrolysis

To protect several miles of 16-in. welded high-pressure gas main and two submarine crossings of similar size from stray-current electrolysis, New Orleans Public Service, Inc., has used a 12-amp., 90-volt full-wave rectifier successfully for three years to impress a negative potential on the pipe and a positive potential on the nearest adjacent street car track.

The rectifier is mounted in an inclosure on a pole and connected to the 120-volt lighting circuits. The initial cost and operating and maintenance expense are low, according to Robert J. Kuhn, electrolysis engineer, the hot-bulb rectifier tubes having lasted over a year of continuous operation. Among conditions essential to its successful operation are: Use of "clear-winding" transformers, electrically continuous pipe line, insulation of pipe and laterals from other metallic structures, and use of pipe coating having a permanently high resistance per square foot of surface.

This application is more applicable to transmission pipe lines in either the city or country than to distribution networks with their large number of services.

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New X-Ray Paper Tube May Extend Field of Use

By substituting laminated paper for the glass commonly used for the body of X-ray tubes it is thought that higher voltages than are generally used may become thoroughly practicable. In the most recent issue of the *Physical Review,* official publication of the American Institute of Physics, an experimental installation at the Palmer Physical Laboratory of Princeton University is described which holds high promise.

This tube has been built as part of experiments to develop X-ray tubes for the 10,000,000-volt Van de Graaff static electricity generator, now nearing completion at the experiment station of Massachusetts Institute of Technology (ELECTRICAL WORLD, January 4, cover).

The new tube is cylindrical in shape, about one-quarter of an inch thick, four feet in length and seven inches in diameter. Brass plates are fastened on to the ends with cement, and the laminated paper is impregnated with shellac. Another feature is an India ink line drawn in a spiral thread on the outside of the cylinder from one end to the other. This line strengthens resistance to puncture by the high voltages inside, and also prevents sparks from forming on the outside. To prevent moisture the tube is sealed with a paraffin-like substance.

Previously, according to the *Physical Review,* such material was not found practical for X-ray tubes because of leaks and adsorbed gases which clung to the inside surfaces. Improvements in high-speed vacuum pumps eliminated these difficulties.

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Stall-Safe Appliance Motors Arrive

Though left stalled on the line day and night for months, this ⅛-hp. Westinghouse motor for refrigerators, oil-burners, etc., protected itself from burnout by means of a small integrally mounted thermostat which opens the circuit when the motor gets too hot and restarts the motor again after it has cooled. Without the thermostatic protection it would have burned out in twenty seconds. In 840 hours the protective device operated 46,200 times without failure.

This development permits the last available ounce of torque to be extracted from motors for domestic appliances with perfect safety. Overloads mean nothing, for their duration is automatically metered by the thermostat's response to damaging temperatures; for example, with 150 per cent full load the thermostat disconnects the motor after 90 minutes, while 300 per cent load is safely carried but seven minutes. As soon as the motor cools down sufficiently it takes up the load and carries it until the temperature again becomes dangerous.

EDITORIALS

L. W. W. MORROW
Editor

Speaking frankly

WHEN a company's net revenue has been reduced so much that its bond interest or preferred stock dividends are endangered, or it is liable to be embarrassed by bank loans or maturing securities, there is hardly any question as to what any one would do if he had the responsibility of the executive chair. For one thing, he would not incur any new financial commitments unless they would effect immediate net savings or make possible more business and increased net profits.

But this depression has *not* brought every organization to the state where such drastic retrenchment is essential or even advisable. In fact, it is firmly believed that necessary expenditures are being postponed in enough cases so that collectively they would put sufficient money in circulation to turn the general business tide. What we need today is just enough increment buying by every one to make unnecessary further curtailments in salaries and wages, further receiverships, and to stimulate equipment industries which keep alive other product-contributing industries, their employees and all commercial pursuits that rely on their purchasing power.

If these organizations which have been unnecessarily cautious would make an inventory of every opportunity for rehabilitation which they know should not be allowed to remain much longer, and would also list any expenditures which could be made to develop a bigger market, the collective expenditures would turn the trick. If those who are able to act now continue their retrenchment, how do they expect business to get better? It cannot grow on inaction. It is time to ponder the effect on business and money of carrying this retrenchment to the extreme.

Business men, industrialists and individuals, could benefit themselves immeasurably by banding together in groups which not merely verbally but actually refuse to continue the overcautious policy which some are following. And if financiers continue to think it is entirely up to others to restore business, they may be left holding worthless securities and currency. Persons who rely on income from invested money must accept an equal burden with those who sell their services if we are going to have a balanced adjustment of the present situation.

After realizing that locking the purse is more liable to accentuate business and monetary downfall than to safeguard the future, then there may be enough enlightenment to foresee the future return on expenditures made now at low material and labor prices. Something for all equipment buyers to consider is that, unless buying increases, manufacturers' research and development, which have thus far enabled much of the progress in the last 25 years, will be curtailed or stopped, imperiling future progress, and continued failure of manufacturers will remove the competition that promotes newer and better products at reasonable prices.

Maybe we need a bulletin board of purchases made by every organization to reveal publicly the slackers in this war on depression. More reports on how spending money has effected net savings or profits would be more helpful in restoring business and employment than continued harping on economies alone.

Let it be hash if that's what the public wants

LOCKSTEPS and chain gangs are degrading spectacles under any circumstances. Railroads are the victims of that philosophy of regulation. Other utilities have continued to support local regulation in the hope that it could be diverted from such an ignominious end. If it cannot be so diverted a good alternative will have to be found short of the worse alternative of universal governmental administration of all utility services. What will that alternative be?

Little by little regulation, in its aim to become vigorous, enlightened and responsive to public desire, is wandering into subversive details. Oregon's sole commissioner asks legislation that utility budgets be submitted so that proposed expenditures can be scrutinized before they are made, rather than criticised when it is too late. Norris wants uniformity in rates over all the affiliates of any top structure that engages in interstate transmission. Various state commissions attempt the same thing, often disrupting local contentment with existing rate forms. Others substitute their rate hobbies for the informed judgment of the management on such things as absorbed kilowatt-hours in minimum charges as a substitute for a straight service or demand charge.

Undoubtedly the effort of the commissions is sincere, but under existing machinery for getting public preferences expressed in a balanced manner the utilities have the edge on the commissions. There is where the alternative to biased regulation lies. If the utilities can find what the customer really wants as to rate forms, inducements, supplementary services and aid in acquiring the use of major appliances, they can change the whole picture of regulation. There would be less stress on cost of service and more on value of service.

It may mean hash in rates instead of blissful uniformity. It may mean all the riot of barter and sales appeal, even to the shedding of the cloak of monopoly. But if competition and repression join hands to stifle the realization of the public's desires for an unlimited and unhampered electrical era what now, at a distance, looks like hash in commercial technique may prove to be far superior to geometrically trimmed sirloins and perfectly ellipsoidal potatoes. If the public wants hash and gets it the commissions may be asked to justify the rigidity of the current menu. This may be the way to interpret present tinkling sounds—they are merely the illusory effects of the clanking of chains in the distance.

Chiseling away earnings by meter rulings

ALL KINDS of efforts are being made in some quarters to trim away the bit of flounce that keeps the utility's skirts from shrinking indecently. The latest move is the proposal of the New York Public Service Commission that no "fast" tolerance shall be allowed for electric meters upon installation or if discovered on subsequent periodic test. In other words, if a meter cannot be set absolutely accurate it must be set slow.

Such a ruling savors strongly of play to the galleries. It can have no technical justification. Tolerances of one to four per cent are permitted in other commission rules solely for the purpose of keeping cost of testing within reasonable limits and to allow for the slight uncertainty that is present in all commercial measurements where laboratory precision is not practically possible of attainment. Electric meters are as likely to run slow as fast. Nothing about the technique or the characteristics of the watt-hour meter justifies the establishment of a one-way tolerance. Such a ruling is repugnant to the whole theory of measurements and the probability of errors. Any one meter over the interval between tests or the average of all meter tests in a year will come nearer to the true objective of 100 per cent accuracy if the tolerances are plus and minus than if they must be set entirely on the slow side.

If this commission believes, as it well may, that electric metering technique has improved so that its tolerances can properly be reduced, then the margins should be allowed in reduced magnitude on both sides of flat accuracy. It is by virtue of the same kind of reasoning that the commission has recognized that the improved performance likewise justifies an extension of the prevailing three- or four-year periodic test interval to six years, with consequent saving in operating cost to the utility, and in the end to the customer.

Industrial Plant Saves by Electric Welding

By R. J. COLLINS
Plant Engineer Millers Falls Company, Greenfield, Mass.

BECAUSE the average management is fully informed on productive machinery and accepts maintenance as a necessary evil without endeavoring to understand its problems it is easier to sell industry a $5,000 milling machine that will show a 10 per cent saving over annual fixed charges than to persuade it to buy a new tool for maintenance at $1,000 that will show a 200 per cent annual saving. Nevertheless, an inefficient maintenance department can keep the most efficient production organization in the red. Be this as it may, one of the most revolutionary tools which can be added to the maintenance department is an electric welder. Under intelligent management such an equipment will cut costs to a surprising degree.

In the average metal-working plant arc welding applications may be classified as follows: (1) General repairs; (2) building new equipment; (3) building jigs and fixtures; (4) experimental design and construction; (5) production building.

1. *General Repairs*—This welding application includes the building up of worn surfaces, cams, operating levers, ways, fixtures, motor shafts, arbors, etc., by adding a layer of metal sufficiently thick to machine or grind to the original size. On difficult jobs, where it is possible to grind, this built-up section can be of hard-surfacing material like stellite, borium, manganese or nickel, making the job better than before. Thus, the heavy wear resulting from the stiff metal-to-metal blow of the stop and cam of a drop hammer may be materially lessened by coating both surfaces with manganese steel and rough grinding to size, which greatly increases the life of the machine. All broken parts, whether of steel or cast iron, can be satisfactorily welded. An important advantage of electric arc welding resulting from the small generation of heat in the piece being handled is that welding can often be done without removing the broken part from the machine. In the case of a 3-in. section which was broken from the operating drum of a National Automatic screw machine the piece was welded in place, saving about two days in disassembling and also two days' productive time. The low heat of electric welding also makes it unnecessary to remove hardened bushings, bronze liners, etc., before repairing.

Parts of alloy steel, mild steel, carbon steel, cast steel, iron, cast iron, malleable iron, bronze, copper, monel metal, nichrome and "Q" alloy can be electrically welded. Experience teaches the right heat, electrode and preparation of metal. Alloy steels require special treatment, but all can be welded to mild steel. We have had no real difficulty in welding steel to cast or malleable iron, although it must not be forgotten that the weld is only as strong as the iron and a large surface is required for adequate strength. The welding of steel to cast iron should be discouraged except where absolutely necessary.

In repairing a saw bench arbor 4 ft. 6 in. long, with a $1\frac{7}{16}$-in. screw stock and flanged saw end 5 in. in diameter, the cost of making a new piece was $18.06, as follows:

Steps — (*a*) Screw stock, center and turn to true; (*b*) shrink on flange; (*c*) turn flange on shaft to $1\frac{7}{8}$ in. diameter; (*d*) turn 7 in. of shaft to 1 in. diameter and thread $1\frac{1}{4}$ in. long.

Labor, 12 man-hours at $0.60	$7.20
Overhead of department 88 at 120 per cent	8.64
Material 54 lb. steel at 3.5 cents	1.89
5 lb. cast iron at 6.75 cents	0.337
Total	$18.06

The cost of welding electrically by the most economical method was:

Labor (department 80) 1.5 hours turning	$0.975
0.75 hour welding	0.49
Overhead of department 80, 110 per cent	1.60
Material	0.50
Total	$3.56
Saving by electric welding	**14.50**

In repairing a bending machine by outside acetylene welder, with 24 hours' delay, the price was:

Oxygen	$7.50
Acetylene	8.50
Material	7.85
Labor	16.00
Total	$39.85

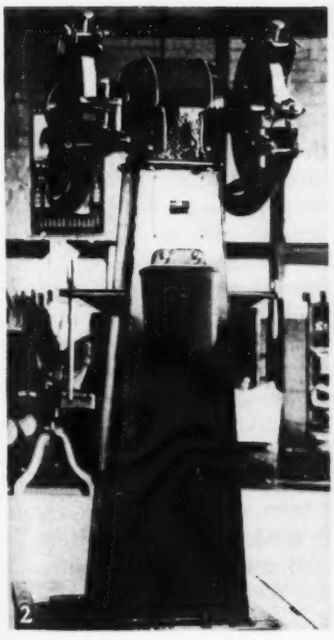
By electric welding:

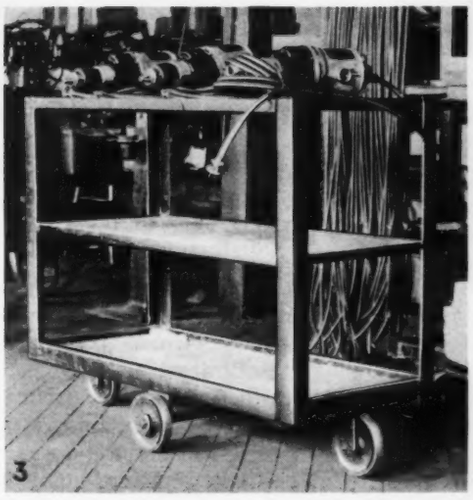
One man 4 hours	$2.60
Overhead 110 per cent	2.86
Material	2.00
Total	$7.46
Saving by electric welding	**32.39**

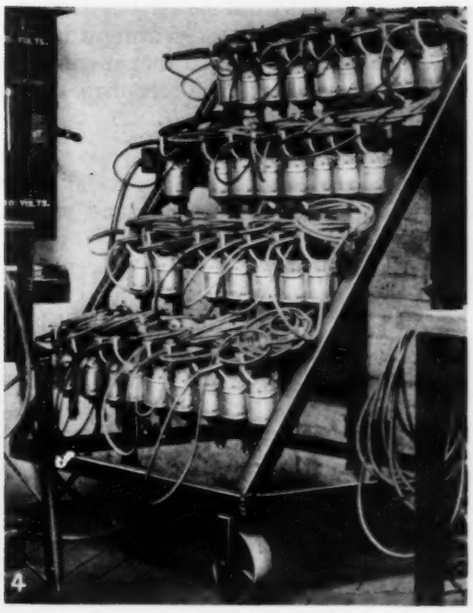
A saving of $12.92 was made by electric welding in building up the edge of a table on two drill presses over a cost of $15.29 by acetylene welding, and $28.37 was saved in electrically welding a broken tooth in a 1,000-lb. drop hammer gear. In this case the electric welding cost was made up of twelve hours' labor, $7.80; overhead, $8.58; material, $2; total, $18.38. There was a delay of $1\frac{1}{2}$ days in repairing this gear by outside acetylene welding. A sanding machine was electrically welded at a cost of $21.12, against an outside hired job of $35.32, and a dipping machine was welded in the local plant at a cost of $40.89, against an outside bill of $69.05. On nine jobs the total saving was $179.19. The chief disadvantage of outside welding was the necessity of sending a man to supervise the work or else to supply a blueprint layout.

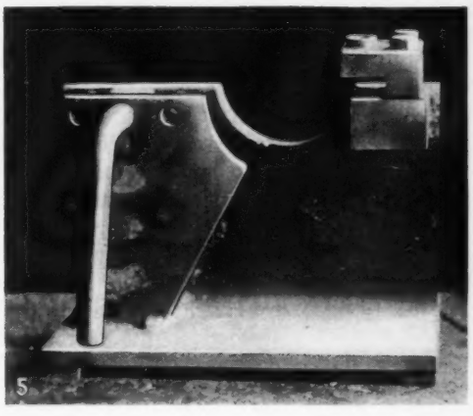
2. *Building New Equipment*—This includes tool racks, shelves, trucks, special frames, tanks, pots, handling

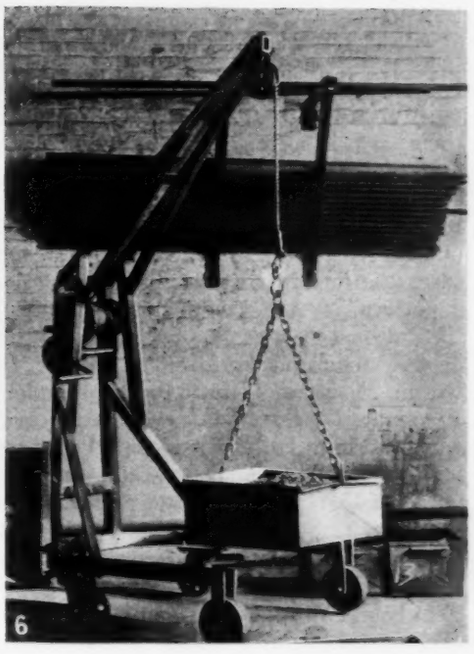
An Endless Variety of Economical Electrical Welds Is Suggested by These Examples

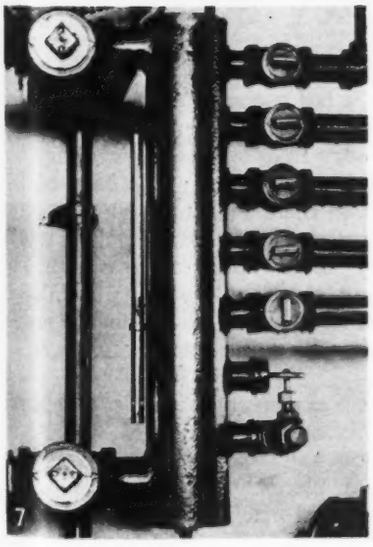




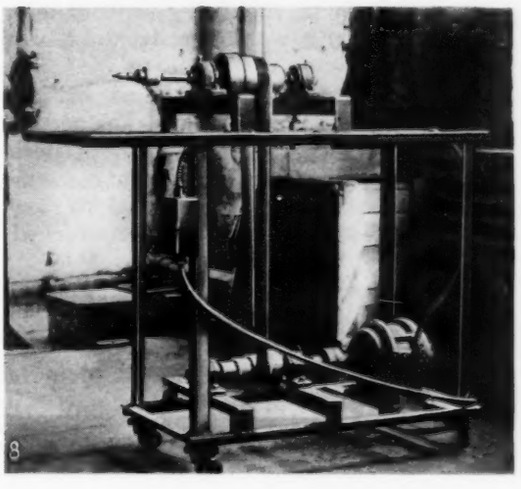








1. High-speed steel-forming tool welded to mild steel base
2. Welded steel pedestal paid cost of welding by material saving
3. Triple shelf truck without rivets, screws or bolts
4. Portable electric drill truck with welded frame
5. All-steel welded drilling jig
6. Portable crane, capacity ½ ton, with welded frame
7. Special arc-welded gas manifold
8. Portable drilling and burring machine



equipment, structural construction about the plant, special machines, etc., such as securing a motor-driven press to a special truck frame so that it can be placed anywhere in the plant and absorb idle man time which otherwise would be lost.

3. *Welding of Jigs and Fixtures*—This application of welding frequently meets vigorous opposition from some engineers, toolroom foremen and toolmakers. The first contention is that the fixture is of steel and therefore is less rigid than cast iron. The point is correct if the steel fixture is designed along cast-iron lines, but if the design is correct for steel it will be more rigid. The second objection raised is that the fixture will not stay in alignment because of internal strains welded into it. If the fixture is not annealed this is true, but neither will a casting hold its alignment if it is not annealed before machining, and often a casting, if recently made, will not hold its alignment after annealing. It has been proved that a welded steel fixture properly annealed will hold its alignment better than most castings and as well as the best.

The next objection raised is the appearance of steel fixtures. Admitted that the machined casting looks better, but just what is the value of appearance in a fixture? If the machined fixture costs 200 to 300 per cent more than welded steel, is the appearance factor worth it? If we were selling fixtures the situation would be somewhat modified, but instead we are using fixtures, and their cost is a serious item in any machine industry. One of the large electrical manufacturing companies has adopted 100 per cent welded steel for all jigs and fixtures, thereby reducing the cost over 60 per cent. In our experience the saving is still greater; in fact, in many cases the fixture costs less than the expense of making a pattern for the casting; incidentally, the delivery of the finished fixture is speeded up. Our practice is to deliver the annealed welded fixture to the toolroom within 24 hours after receipt of order and blueprint. For example, the high-speed cutter used in one of our wood-working lathes was formerly forged by hand from tool steel. A toolmaker would finish one of these in ten to twelve hours at a total cost of about $15, including overhead (labor rate 70 cents per hour). With electric welding we form the high-speed steel to the approximate shape, grind to a correct shape and then weld to a mild steel base. A toolmaker can complete this task in from two or three hours, which means a saving of from $10 to $13, with the important additional advantage that the high-speed forming tool will give us at least four times the production that we can get from a tool-steel-forming tool.

It is of great advantage to us that no pattern is required with electrically welded jigs and fixtures. The fixtures are fabricated from standard steel shapes and sheets; it is lighter and made from a metal costing less per pound; all surfaces are equal to hot-rolled steel, require little machining and can be modified or repaired by addition if worn.

Before fixture welding can be adopted the welder must not only be "sold" the idea but must have sufficient intelligence to read prints and plan his assembly. The engineering department must get "welding minded" and study its practical applications. The draftsman must obtain a general idea of welding design and practical assembly problems, and, finally, the toolroom must overcome prejudice and co-operate in cost reduction, especially in regard to finish. Only where it is clearly necessary should parts be finished, and the urge to grind all surfaces to a mirror-like appearance should be discouraged.

4. *Experimental Design and Construction*—Welding greatly facilitates this work. To illustrate, consider that a base is wanted for an electric bench drill. This of course could be drawn, the pattern made and the casting obtained. Often the finished casting lacks the right appearance or must be modified, which means practically repeating the job. By welding electrically, the base could be fabricated from steel, duplicated in casting and, after a satisfactory design had been found, assurance would be had of the pattern being the final one. In another case we were experimenting with the design of a new tool of cast iron. It was necessary to add a boss to be drilled and tapped, and the surest way to do this without the possibility of developing a hard spot was to weld a steel slug to the casting. This was done with entire satisfaction, drilling and tapping following.

5. *Production Building*—In a number of cases we have found it economical to replace castings by welded steel. Grinder pedestals were successfully made of sheet stock at a substantial saving, at the same time obtaining a better looking product. These were made standard due to direct saving, and the reduction in weight alone paid for the welding. The cast-iron pedestal weighed 110 lb., costing, at $6\frac{3}{4}$ cents per pound, $7.32, and the cost of the production operation and of finishing was $5.31, or a total of $12.53. When replacing with electrically welded steel the pedestal weighed 67 lb. at 3.8 cents per pound, or $2.53, and production and finishing costs were $4.57, a total of $7.10 and a saving of $5.43 each.

In another case it became necessary to extend the bed of a milling machine 14 in. To do this in cast iron would have meant a special casting, machining to fit and elaborate bolting, or, if the casting had been welded to the bed, there would have been danger of warping on account of the size of the weld. Instead of this, the extension was fabricated from steel and this in turn was welded to the original bed. As the weld was steel to casting, the cross-section of weld was small and the heat of the welding operation was low, causing no distortion. The work has been in use more than two years without failure.

Adaptation of electric welding to plant

Electric arc welding is but a comparatively few years old in industry. Each year sees new industries using it. A few things are necessary in adopting arc welding in a plant. Above all, the plant foremen must all be of the type readily to adapt it to their departmental work, for it is these men who create the jobs around a plant which justify the investment in welding apparatus. The investment in a welding outfit will pay no dividends unless the equipment handled every job within its scope. The slogan to adopt is, "Try the welder first on all repairs."

The idea that welds are not strong is a misconception. If the welder knows his business the weld will be as strong as the base metal and stronger than any other method of uniting two pieces. Another idea often advanced is that welds are not machinable. This depends

on the kind of wire used and the method employed. If these are correct the weld will be as soft and machinable as the base metal, with the exception of cast iron. Here the purity of the casting enters the situation. Naturally welds of hard surfacing like "stoodite" borium, stellite, manganese or nickel cannot be machined. If this were possible we should not have hard surfacing.

A company employing foremen who are not alert to economical methods will soon cease to exist under modern competition, for the margin of profit in most industries is drawn so fine that inefficient operation dooms it to be reduced to zero in due course. Under some modern industrial systems costs are checked closely and in many of them the foreman's salary is in direct ratio to the efficiency of his department, with a set minimum which eliminates him in case he falls below it. Electric welding has proved that it will cut costs, and all that is needed is intelligent application. In any industry the success of welding development is in direct ratio to the degree of co-operation existing between the management, engineering, toolroom, maintenance and production departments.

Nevertheless, the presence of a well-informed "doubting Thomas" is an asset in any organization if he has a real prejudice against welding and can advance innumerable reasons why welding is undesirable. This is so because the tendency after adopting welding is to lean too far forward in its behalf, and so the prejudiced individual will keep the welding minded ones "on their toes" to justify their position; holding them on the ground, as it were, and preventing mistakes. In our plant this opposition eventually capitulated and became the most ardent champion of welding, but before this happened the rest of us were forced to study our positions and make sure that we were right. In our plant the total investment in electric welding equipment was less than $2,000. We employ two 200-amp. outfits, one being a Wilson and the other a Hobart. To state what they have earned us would be difficult as not a day passes when these outfits do not add to our indebtedness to them. The plant engineer is in personal charge of all welding, having taken the original course at the Wilson company's factory, after which he trained a master millwright and various toolmakers to do this work.

Effect of Busbar Insulation on Heat Dissipation

By R. J. COE

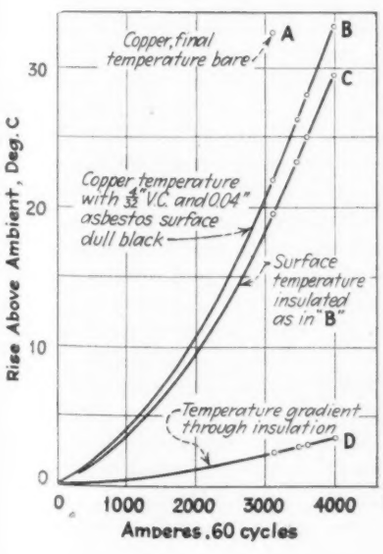
New England Power Engineering & Service Corporation, Boston, Mass.

In connection with the insulation of indoor high-voltage buses to prevent flashover troubles, tests indicate that with cylindrical conductors a reasonable amount of insulation, with proper attention to the character of the final surface, will increase the allowable current-carrying capacity for the same temperature rise. Similar measurements on a two-bar assembly indicate that there is very little difference in heating between the bare and insulated conditions for both vertical and horizontal axial suspensions.

The tubing tests were made on a 16-ft. length of 4-in. extra-heavy iron pipe size copper. Temperatures were measured by copper-constant in thermocouples after uniform initial temperatures were established. The return conductor was located about 4 ft. away from the test conductor to avoid heat influence. In the tests the final temperature reached by the bare tube carrying 3,120 amp. was 32.5 deg. C. above ambient. The tube was then insulated with five half-lap layers of 0.012-in. thick varnished cambric with insulating varnish applied between layers and a final covering of one half-lap layer of 0.02-in. asbestos tape. The outer surface was given two coats of dull black cable paint. Additional thermocouples were installed for surface temperature readings.

The results showed that the small temperature gradient through the insulation is more than offset by the greater heat-dissipating ability of the black painted asbestos as compared to the bright metallic surface of the bare tubing. The net result is increased current-carrying capacity for the same temperature rise.

A series of bar tests was made on an assembly of two ¼x3-in.x12-ft. copper bars spaced ¼ in. apart. In this case the insulation was applied encircling both bars. It consisted of two half-lap layers of 0.012-in. varnished cambric, one half-lap layer of cotton tape and two coats of dull black cable paint. Thermocouples were applied at three points on the inside surfaces of the bars. With the bars vertical there was a slight increase in heating due to insulation, the carrying capacities corrected to 30 deg. rise being 1,590 amp. for the bare bus and 1,530 for the insulated bars. When the bars were placed with their long axes horizontal the insulation caused a reduction in heating. On a 30-deg. rise basis the bare capacity was 1,490 amp. and 1,550 amp. for insulated bus capac-

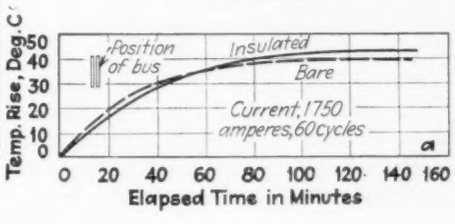


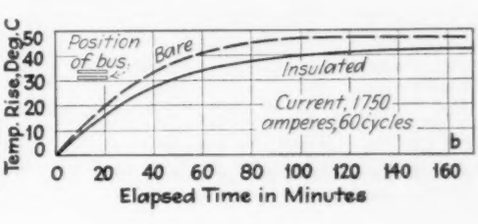
Temperature rise of copper tubing with current increases

Insulation of conductor with proper surfacing increased carrying capacity.

Insulated bars better than bare when horizontal

(a) Insulated busbars mounted vertically show slightly higher temperatures after hour's run; (b) horizontally mounted insulated buses run lower than bare bars through entire period of current application.





ity. In the two-bar assembly the heating was only slightly changed by adding insulation, despite practical halving of the heat-dissipating surface by eliminating the inside surface of the bars. With the tubing the surface was slightly increased, and this, with the improved ability of the surface to dissipate heat, resulted in lower temperature rise.

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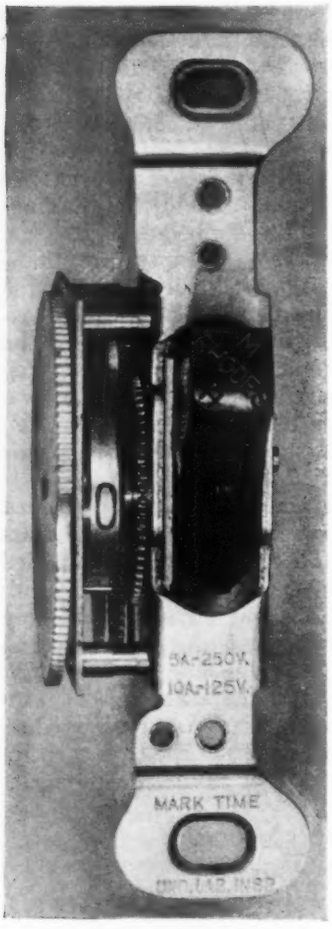
Building Commercial Load with a Time Switch

By H. H. WEBB

Illuminating Engineer Dayton Power & Light Company
Dayton, Ohio

Two-thirds of the commercial meters in Dayton serve places of business with less than 2 kw. connected load. About 1,800 of these are small retail stores.

If the commercial lighting revenue from these stores is to be increased in times like these the cost to the customer for both additional lighting equipment and energy must be kept to a minimum. We feel that 200 to 400 watts in show window spotlights in a very small retail store can profitably be used about three hours a night after the store is closed and the advertising value to the merchant of this lighting will greatly exceed the cost of operation. Incidentally the revenue to the lighting company can be considerably increased.



Low-priced time switch fits in standard switch box

After circuit is closed by pulling toggle down the act of setting dial to any required time delay within fifteen hours winds the mainspring. After setting dial, toggle is pushed to off position. Circuit then opens at expiration of indicated time.

A survey will show a surprisingly large number of these small stores with window lighting of some kind, or an electric sign, already installed, but unused after the shopkeeper closes his door, simply for lack of means for turning the lights off two or three hours later. All that is needed to obtain this additional revenue is a low-priced time switch, simple to install.

A $15 or $20 time switch, together with its cost of installation, is something that does not interest the average small merchant. He realizes the advantages of keeping his windows and sign lighted after dark, but doesn't feel free to spend this amount of money.

There has recently appeared on the market a time switch of such size that it can replace an ordinary tumbler or push-button switch. The old switch is removed from the box and the new one inserted. Our lighting salesmen have shown this device to about 150 of our small commercial customers, with the result that 23 of them have so far been sold. We intend to call on every available prospect during the course of the next two to three months. The retail price of the switch is $4.75 and arrangements have been made with local contractors to make the installation at a flat price of $1.50 additional, making the total installed price $6.25, payable with the light bill at $1.25 per month for five months. This installation cost might seem high, but in some cases it is necessary to replace a rotary snap switch and install a box. The salesman is paid a bonus of $1 for each switch sold.

The average wattage controlled by the switches we have sold up to date is 280. This means an annual revenue of about $13, counting three hours a day at 5 cents per kilowatt-hour and 310 days a year.

It is much easier to sell this idea to the small merchant than to influence him to install a complete window-lighting job at a cost of from $40 to $50. It introduces a new idea to him, and we believe it will be possible to go back to him a year from now and sell a more complete installation of show window lighting. In the meantime, however, the low-priced time switch enables him to make fuller use of the present lighting equipment which he already has, whether it be window lighting, an electric sign or a floodlight, for an outlay of only $5 or $6.

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Making Electric Service Easier to Buy

"Why make the commodity you sell so hard to buy?" How often has this criticism been hurled at the public utilities. To overcome this attitude where it has been justified is the object of the 1933 rate program of the Central Hudson Gas & Electric Corporation.

The new program by which this company hopes to encourage and popularize the use of electric service by making it easier to buy has meant the unification and simplification of its entire rate structure. This has been accomplished largely by getting rid of optional rates and eliminating involved restrictions and regulations such as special minimum charges and yearly contracts for customers operating electric ranges and seasonal minimum charges which were payable in advance. These optional rates and charges have always been hard to explain and have been a detriment to good public relations. Further simplification which has met with wide public favor during this period of business depression and forced shutdowns has been accomplished by putting the demand charges for commercial and power customers on a monthly rather than on a yearly basis.

For electric service the new rates will eliminate all

optional service classifications previously available and will substitute a single residence rate, a single commercial rate and a single general power rate applicable to all service in these respective classes in each rate district. These rates combine substantially all of the advantages to customers previously provided for in the optional rates without losing any of the promotional features so valuable to the company in developing added business.

Residence service charges in each of the company's rate districts, comprising four groups of similar communities, will be made under single residence rate. Commercial service will likewise be available in each district under a new rate providing for the use of a monthly demand for billing purposes in lieu of the fixed annual demands previously in effect. For general power service the rate will be uniform throughout the entire territory served by this company and also provides for the use of monthly demands in lieu of annual demands.

As a result of these changes one electric rate schedule with fifteen classifications will be substituted for four existing rate schedules with 81 classifications.

This one new rate schedule will mean a decided saving in administrative expense for the utility and a resulting saving to customers estimated at $232,000.

As a result of an aggressive commercial policy in making voluntary rate adjustments residence customers in Central Hudson territory have increased their electric usage 140 per cent since 1924.

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Capitalization Checks Investment

TOTAL capital invested in the electric light and power industry was given in the January 7 statistical issue of ELECTRICAL WORLD as $12,600,000,000. Such a figure can at best be only an intelligent and informed estimate based upon census reports and data on new capital expenditures. It is interesting to note, however, that this estimate can be confirmed by reasonable interpretation of the detailed figures on the capital structures of operating utilities embraced in the Bonbright Survey of the Electric Light and Power Industry, just off the press.

Bonbright Survey accounts for $8,982,002,219 of capital value carried directly on the books on the basis of par or adjusted stock values. This is made up of the following items:

Funded debt	$5,781,397,805
Preferred stock	1,438,557,188
Common stock	1,762,051,226

In addition there are the 119,106,029 shares of common stock and the 8,675,786 shares of preferred stock of the no-par class, the values of which are strictly obtainable only by a conventional determination of their net worth. The problem in setting up a grand capitalization for the industry is then to assign some reasonable value to the no-par shares of both common and preferred. The summary of the detailed data in the Bonbright Survey (as presented in Table I) can be made of aid in conjunction with the expenses and taxes reported in the statistical issue of ELECTRICAL WORLD (January 7, 1933).

In approaching this approximation, it is only necessary to deduct operating expenses, taxes and the carriage of funded debt from the gross receipts and then make a further deduction for reserves to depreciation, retirement and surplus. The residue can be attributed to the earnings on equity holdings. The process can be continued another stage by deducting reasonable average value of dividend disbursements on the par-value preferred and common shares to derive a remainder which can be allocated to the no-par shares and thus provide a basis for assigning a capital value to them. Thus:

Gross revenue		$2,164,000,000
Operating expenses	$880,000,000	
Taxes	220,000,000	
Reserves	250,000,000	1,350,000,000
		$814,000,000
Bond interest	240,000,000	
Dividends on par preferred	93,000,000	
Dividends on par common	140,000,000	473,000,000
		$341,000,000
$5 dividends on no-par preferred	44,000,000	
$2.50 dividends on no-par common	297,000,000	341,000,000

To arrive at an over-all capitalization figure it remains to capitalize the aggregate of no-par stocks in terms of these assigned earnings and incorporate them with the bonds and par valued shares which have been given a book value in the capital reports of the utilities.

Bonds	$5,781,397,805
Preferred stock	1,438,557,188
Common stock	1,762,051,226
	$8,982,006,219
Preferred (8,675,786 shares at $62½)	547,000,000
Common (119,106,029 shares at $25)	2,980,000,000
Total capitalization (round numbers)	$12,509,000,000

Table I—Bonbright Survey Summary of Utility Capital

Totals as of or for Year Ended September 30, 1932

	Common Stock		Preferred Stock			Gross
	Dollars	Shares	Dollars	Shares	Bonds	Revenue
New England	340,217,277	544,130	64,674,150	332,073	302,072,000	187,281,267
Middle Atlantic	220,663,433	43,934,886	230,412,747	2,338,659	1,335,844,813	686,533,738
East North Central	538,983,170	10,920,999	434,414,449	837,000	1,337,565,221	480,310,924
West North Central	111,168,076	6,115,457	192,771,027	623,780	567,093,906	168,489,510
South Atlantic	123,438,348	21,676,162	63,049,600	2,108,302	680,544,095	197,650,493
East South Central	3,151,880	8,750,134	47,108,128	701,644	246,307,000	67,802,076
West South Central	27,530,000	14,075,632	37,164,223	683,692	370,882,070	101,924,549
Mountain	40,603,247	8,085,041	30,149,382	488,567	188,119,250	49,412,468
Pacific	356,295,795	5,002,688	338,813,482	562,069	752,969,450	225,408,031
United States	1,762,051,226	119,105,129	1,438,557,188	8,675,786	5,781,397,805	2,164,813,056

Table II—Less Than Half Light and Power Capital Is Funded

	Gross Earnings	Estimated Total Capitalization	Dollars Gross per Dollar of Capitalization	Dollars Gross per Dollar of Funded Debt	Funded Debt — Dollars	Funded Debt — Per Cent Capital	Preferred Stock — In Dollars — Dollars	Preferred Stock — In Dollars — Per Cent Capital	Preferred Stock — In Shares — Dollars and Shares	Preferred Stock — In Shares — Per Cent Capital	Preferred Stock — In Shares — Per Cent Capital	Common Stock — In Dollars — Dollars	Common Stock — In Dollars — Per Cent Capital	Common Stock — In Shares — Dollars and Shares	Common Stock — In Shares — Per Cent Capital	Common Stock — In Shares — Per Cent Capital
New Englan	187,281,267	741,321,227	0.254	0.622	302,072,000	40.80	64,674,150	8.72	20,754,500 (322,073)	2.80	11.52	340,217,277	46.0	13,603,300 (544,130)	1.84	47.84
Middle Atlantic....	686,533,738	3,031,459,693	0.227	0.513	1,335,844,813	44.10	230,412,747	7.60	146,166,500 (2,338,659)	4.82	12.42	220,663,433	7.27	1,098,372,200 (43,934,886)	36.20	43.47
Middle West.....	648,800,434	3,699,206,249	0.175	0.341	1,904,659,127	51.50	627,185,476	16.95	91,299,000 (1,460,780)	2.47	19.42	650,151,246	17.55	425,911,400 (17,036,456)	11.50	29.05
South.....	367,377,118	2,930,076,044	0.125	0.283	1,297,733,165	44.20	147,321,951	5.02	218,352,500 (3,493,638)	7.45	12.47	154,120,228	5.26	1,112,548,200 (44,501,928)	37.90	43.16
West.....	274,820,499	2,099,808,306	0.131	0.292	941,088,700	44.80	368,962,864	17.60	65,664,500 (1,050,636)	3.13	20.73	396,899,042	18.90	327,193,200 (13,087,729)	15.60	34.50
United States..... (Shares)	2,164,813,056	12,501,871,519	0.173	0.375	5,781,397,805	46.20	1,438,557,188	11.50	542,237,000 (8,675,786)	4.33	15.83	1,762,051,226	14.10	2,977,628,300 (119,105,129	23.8	37.9

This figure is in close accord with the value of the capital investment accepted for the industry and arrived at by cumulative census and budget statistics. It may therefore be reasoned that the assignment of $62.50 per share for no-par preferred and $25 per share for no-par common is more or less substantiated.

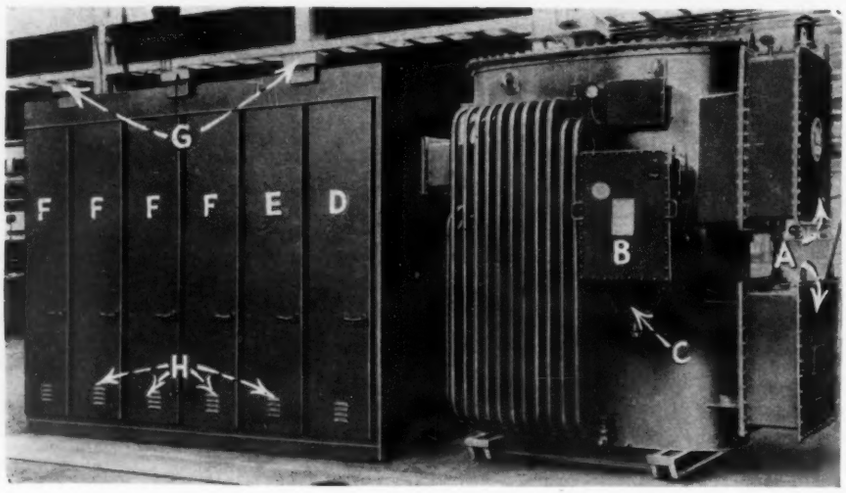
Data assembled from the companies in the Bonbright Survey (as presented in Table I in summary form) makes it possible to infer both national and regional trends in financing. Such an analysis has been carried out in Table II. Funded indebtedness constitutes from 40.8 to 51.5 per cent of the total capitalization. New England presents the low figure and the Middle West the high one. As for preferred stock, the low ratio (11.52 per cent) is again in New England and the high ratio in the far West (20.73 per cent). The tendency to employ no-par preferred is greatest in the South and least in the Middle West. On the other hand, the tendency to assign specific capital value to the preferred is greatest in the Middle West and least in the South.

New England, with the lowest bond ratio, also has the most pronounced preference for common shares, but with a very minor predilection for no-par shares. The Middle West, with a stronger leaning to bonds, divides the common and preferred in a 30 to 20 ratio, with a roughly equal tendency to assign par value and to use no-par stock. The South and Middle Atlantic areas are the ones which lean strongest to the no-par status. The Mountain and Pacific regions (West in the table) show no particular partiality for either practice in connection with common shares.

Once again it should be emphasized that these inferences are based upon the adoption of a total capitalization which rests on a certain amount of hypothetical assumption. While these assumptions are believed to be representative of nation-wide average practice, there are regional preferences for $100, $50 and $10 nominal values for no-par shares which depart substantially from the $62.50 and $25 values assigned here to preferred and common shares respectively. Wherever these departures are pronounced and occur in conjunction with a sizable issue of these shares (Middle West and South) it will tend to modify the percentage distribution. It will also have its effect in modifying the apparent earnings per dollar of capitalization. Even making a generous allowance for such a discrepancy, it still will appear that the South and West show much lower gross per dollar of capitalization or investment than the New England and Middle Atlantic areas, where load density is high and the systems are older and more concentrated.

▼ ▼ ▼

Outdoor Type Primary Network Unit



An outdoor type primary distribution unit has been developed by the Westinghouse company for use in a primary network or as a small radial distribution or industrial substation. This unit indicates the growth of the factory-built substation and the primary network. It is only 23 ft. long, 10 ft. 3 in. high and 9 in. wide with the doors of the switchgear compartments open and is rated at 1,500 kva., or 2,000 kva. with blowers.

(A) Automatic load tap-changing equipment. (B) Oil-filled three-position primary disconnecting and grounding switch. (C) Compound-filled pothead for primary cable entrance. (D) Section containing distribution transformer which provides auxiliary power, tripping battery with its "Rectox" charger, instrument and metering panel and space for hookstick, breaker hand-closing lever, tank lifter and other accessories. (E) Transformer breaker section. (F) Feeder or network main breaker sections. (G) Weather-proof discharge ventilators. (H) Intake ventilators.

When Odds Are Against You

By DEAN W. TAYLOR*
Utility Management Corporation, New York

Rates to meet competition.
Selling your own people.
Getting over investment hurdle.
Giving power company opportunity of refusal.
New conditions demand new thinking.

SUPPOSE after completing an exhaustive investigation and power sales report you find that the odds are against you. What to do? Change the odds—if possible, remembering that the odds are always against you if you "let nature take its course." The very fact that you have any prospects left on your list is evidence enough that everything is not always in favor of purchased power. Sometimes the economics are against you; sometimes a reputation for poor or inadequate service must be lived down; sometimes there is not money to finance the changeover—but more frequently it is the "no" man in the prospect's organization who does not believe you can save him money. Until this "no" man has been convinced, the odds are heavily against you. The question is, how to convince him against what he may consider his "better judgment?" The only way out is to make the odds even by offering something better than an even break on some one feature of your proposal.

If the odds against you are economic ones, resulting from demonstrated lower costs of private than purchased power—capitalize the history of rate reductions throughout the central-station industry. Capitalize, if you can, any particular reductions which your company has made over a period of years. In this way you may be able to impress the prospect with the fact that the greatest prospect of future reductions lies with a service that has behind it a long history of gradual and definite lowering of the base level of its rates. You may be able to demonstrate to the prospect the wisdom of choosing a service that has possibilities of continued reductions instead of committing himself to a practically fixed cost of power over the life of a private plant.

On the other hand, your proposed rate may look low to you but high to your prospect. Maybe the rate *is* low when compared with the general average level of rates, but it may still be high when compared with the prospect's conception of his own costs, or with the amount he may be able to save when purchasing power but continuing to make a large amount of process steam, perhaps from waste fuel. The idea of selling large power at a fixed level of rates, unchangeable as the laws of the Medes and Persians, may do well enough when nearly every form of competitive power is high and stationary in price. But taking the country as a whole, the production costs of competitive forms of power (exclusive of the all-important cost of money and obsolescence which vary with the financial strength and equipment policy of the individual concern) have fallen tremendously within the past five years. For the power salesman to close his eyes to this situation is to court disaster. Rates that were competitive in 1928 are not necessarily competitive in 1933. This is not saying that rates in many companies are not lower now than five years ago. It is merely pointing out that rates are more important in power negotiations today than they ever were. Power sales department representatives should take a place of increasing influence in the company councils that pass on rates. The power sales manager is the direct representative of power customers and prospects and to ignore him in establishing, maintaining or changing rates and rate policies is simply to "count without one's host."

Rates may sometimes be profitably reduced to meet a new competition, provided the resulting drop in revenue from other customers affected is not too great. Again, rates may sometimes be lowered for a new group of competitive loads provided the particular group is not merely a product "class," but a "class" judged by load conditions. There are many ways in which the new competitive problem may be approached if there is a "will" to try to meet it. But frequently the management will not consider anything which it may be pleased to call "tampering" with the rates—it would rather lose the business than take the trouble to work out new rates to meet new conditions, although the present rates may have been originally adopted to meet a specific need at a particular time. Most power rates are lower now than formerly and one factor in bringing them down has been the profit possibilities of promotional rates that bring more business.

A company policy of gradual lowering of power rates to meet competition broadens the base of the company's business and serves the best interests of both the company and all of its customers. It often acts as a powerful deterrent to customers contemplating private plants—customers who may believe they could temporarily reduce their power costs by private generation.

Subjects Covered in This Series

Retaining Existing Customers.[1]
Sifting Power Prospects.[2]
Payment-Out-of-Savings Engine Contracts.[3]
Where to Begin Sales Approach.[4]
Process Steam—an Opportunity.[5]
When the Odds Are Against You.
Meeting Diesel Competition.
Making Power Reports Effective.
Yardsticks for Power Sales.
Power Sales Management.

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[1]*Published Oct. 22, 1932.* [2]*Nov. 19, 1932.* [3]*Dec. 10, 1932.* [4]*Dec. 24, 1932.* [5]*Jan. 14, 1933.*

Conservative industrial managers hesitate making large capital expenditures for power plants when they know they face a definite downward trend in local power rates. They are just a little afraid that the power company may be able to reduce its own costs and rates faster than they will be able to amortize and improve their own power plants. A modern power plant is so much a "tailor-made" affair, so dependent upon an over-all design that will fit a particular industrial operation, that once it is built there is not often much that can be done to improve its economy except to redesign and rebuild. This will prove an expensive procedure for an industrial, particularly if there has come about no need for material expansion. This is why a progressive utility rate policy of gradual lowering of power rates does not reduce profits but, on the contrary, stabilizes and eventually increases profits. Many an industrial concern has learned that it is hazardous to maintain prices when it means restricting markets to a limited number of customers or uses.

The loss of perhaps just a single customer in a restricted market may wipe out a large share of the profits of a utility enterprise, while in a broad market the loss of several customers may be felt with less severity. "In numbers there is safety"—a fact that applies to the number of power customers as well as to the number of counsellors.

The days of wide margins of profit on small volumes of power business are just about over. Power companies will have to take on more business or be satisfied with less.

Selling your own people

If your company is dominated by men who are opposed to lowering or modifying rates to meet the new conditions you may have to do a little missionary work in the "home field." Perhaps some of the difficulties of certain members of the gas industry may be attributed to the maintenance of rates at a level which encouraged competition and even beyond the time when the new competition had made a good start toward capturing the market for low-cost heat. Perhaps there was here and there an inclination to refuse to admit that there was any serious competition.

When selling in a competitive field a company should realize that the value of its service to the customer does bear some relation to the customer's own costs of providing an equivalent service. The average industrial power user is not much interested in the theory of allocation of a utility's costs to the various classes of service. He is out to get the lowest possible cost for a reliable supply of power, and while his business may be an important part of your company's wholesale load, he is quite cool to a sales program predicated upon a cost-to-serve theory. If you are to sell him his requirements you may have to be satisfied with a smaller profit spread than you would like were you selling in a non-competitive market.

All too often power rates are only reduced at times of general rate reductions when all classes of service are considered together. Rates established by commissions under such conditions seldom do the power salesman any particular good by opening up new markets because the domestic customers as a class generally get the lion's share of any general rate reduction. The reason is obvious—the domestic customers have more votes. A power sales department that is alive to its needs and its opportunities will try to get modifications in rates to meet competition, and get these modifications on their merits and when they cannot be confused with other rate changes. In this way the temporary reductions in revenue will be made where they will do the most good—by retaining or obtaining profitable business that could not otherwise be had. It is somewhat surprising how many operating managers do not see the importance of this method of treating necessary changes in power rates.

If your company does not see it your way you may have to take time off from your work with the prospect and attempt to sell your own people on the wisdom of designing rates to meet competition as it is.

Getting over the investment hurdle

Suppose your rates are not out of line with the prospect's own costs, but that a large investment in electrical equipment is required to make the change-over and that the prospect is unwilling or unable to lay out the required amount of cash at this time. Is it better to wait until the prospect feels more flush (at which time he may be better able to finance a new power plant) or should you try to make it possible for the prospect to take your service immediately? Provided the customer's credit is good and his prospects of continuing in business for a term of years is equally good, what harm can there be in allowing him just as liberal terms on motors and transformers as the steam and oil engine companies allow purchasers of their equipment, or as the merchandise departments allow their customers?

Power customers are often willing to pay the established rates for outside power even though they think them a little high, if they can thereby conserve their working capital. More and more it is being found necessary for industrials to use a large part of their working capital in the promotion of their own products. In these times an expansion of the market is more profitable than a slight possible lowering of production costs. The same principle that is followed by the industrial in buying power to conserve his capital could be followed by the utility in trying to develop and hold a power market, now that physical plant and facilities are available of such capacity and efficient character that the attention of the power company management may be profitably directed toward the large industrial power load.

In spite of the depression, which began in 1929, hundreds of industrial power plants of 500 kw. to 5,000 kw. have continued to operate. The owners of many of these plants have experienced difficulty in maintaining dividends, but they claim they have not failed to pay the costs of their private plants. It is reasonable to believe that they could have purchased power, and still pay the cost of it in amounts at least equal to their own operating costs, but they have apparently been unwilling to pay the established rates for power and at the same time raise the cash to pay for a complete changeover to purchased power. Such plants constitute the principal prospects in many territories. Such conditions may be as good as any under which to take over some of these large loads.

If the power company would assist the customer in working out a proper financing arrangement whereby the customer could take care of the actual installation work, whereby the customer and supplier of equipment could utilize jointly the services of a finance company to pay for the bare equipment, and whereby the power proposal would be attractive enough to enable the customer to pay for the changeover out of savings effected—if these necessary but not too difficult steps were taken—many of these potential customers would become bona fide customers.

All of this requires a lot of conscientious effort on the part of the power salesman in the interests of his customer. There is more to selling power than merely quoting a rate and asking the customer to buy. There are many hurdles to be cleared and the investment hurdle may be the most serious. And the only proper "form" is to go over it—do not attempt to dodge it. If you have an economically sound proposal the investment problem can be solved. But of course it can only be solved by an earnest effort to bring together all parties concerned and to anticipate and smooth out any rough places on the road to a completed negotiation.

Give your company opportunity of refusal

Power salesmen sometimes are impatient with their own management because of delay in obtaining approval of proposals that involve the designing and filing of new rates to secure competitive power business. The salesman asserts there is little use in going back to the prospect without a lower rate and a definite offer. Frequently the salesman would meet with more readiness to consider a lower or different rate if the management were certain that the prospect was ready to accept and was through "trading." The power company manager may have reason to believe that the prospect has not made clear what his final position will be and that the quotation of a better rate would only encourage the prospect to ask for more. This element of trading enters many large power transactions and it has been observed that much time and expense would be saved for both parties if the power salesman, after developing the prospect's costs, would seek an expression from the prospect as to just what he is willing to do—on just what terms will he do business—giving the power company the opportunity of refusal.

If a power sales negotiation is handled in this way the power company "knows where it is at" and can determine at what point in the future it will be able to meet the prospect's requirements, even though it is unable to meet them immediately. The prospect may then so shape his plans as to be ready to take advantage of the power company's improved position at a later date. On the other hand, if the prospect merely turns down the power salesman's proposal the salesman may never be able to learn on just what basis he might have had the business, nor how close he may have come to getting it. Giving the company management the refusal on a proposal allows the power salesman to share with the management the responsibility for losing a piece of business.

New conditions may require new concepts of rate making. For example, pipe-line companies have become within the past few years an important class of power user and prospect for purchased power. Pipe-line pumping of oil, gasoline and natural gas has grown to large proportions, with some new problems for the power salesman to solve. Power companies have found the problem of selling much of this load a difficult one when old standards and old rate forms have been used. These pipe-line companies have invested many millions of dollars in a transportation system wherein the very commodity transported may be used as fuel for an engine and where the cost of this fuel, at least at the point of origin, is extremely low. Pipe lines must operate at extremely high load factors if they are to be successful. A combination of high load factor, low fuel cost and the customer in the fuel business means that the power salesman has his work cut out for him and *must* consider the power problem from the standpoint of the user.

This type of prospect is generally little interested in the utility's theory of rates based on the cost to serve. He is interested in securing the low unit pumping costs that he has a right to expect from his high load factor operation. Demand charges, power factor, load factor discount, primary voltage discount, off-peak limitations and the hundred and one possible variations in form and method of application of power rates of adjoining power companies are more irritating than interesting to the average pipe-line operator. Where sales methods fail to take into account these new conditions the result is generally an engine-driven pumping station.

A new rate concept

Realizing these new conditions of a new industry, some power companies have taken a new attitude and have approached the problem from the viewpoint of the user. They have first set up the comparative investment costs and carrying charges on an engine-operated and a motor-operated plant. The operating costs of the engine plant plus the excess carrying charges over a motor-operated plant represent the amount the pipe-line company can afford to pay for electric service. Since the prospect expects to operate the plant at 100 per cent load factor and has set up his engine costs on this basis, the power rate is designed to give equal costs at 100 per cent load factor and the entire bill is put into the demand charge, which carries with it sufficient energy use to operate the pumping station at 100 per cent load factor. Now if the station operates at less than 100 per cent load factor it would save, with engine power, only the increment fuel cost. Consequently, the power rate carries with it an energy credit per kilowatt-hour for the deficiency in consumption below that corresponding to 100 per cent load factor. This credit is approximately the same as the corresponding fuel saving. An example of such a rate would be:

Demand Charge—$65 per kw. per year—which carries with it sufficient energy to operate the station at 100 per cent load factor.
Energy Credit—3.0 mills per kw.-hr. for each kw.-hr. less than that consumption corresponding to 100 per cent load factor.

Under such a rate as this the customer is met on his own ground. He thinks of his own plant as operating at 100 per cent load factor and estimates his power costs on a unit basis corresponding to this ideal condition. The conventional form of rate looks high to him. The form of rate here mentioned takes this new condition and this kind of thinking into account, and in comment-

ing upon it the power sales manager of one power company said:

> This type of rate structure may not meet with the approval of the rate engineers of some of our companies for the reason that it does not take the average power company's viewpoint, but rather is predicated upon the customer's viewpoint and conditions of a large investment requiring high load factor. However, it is my opinion that if we are to stay in the power business and continue to obtain new business against oil-engine competition the rate engineers will have to thoroughly revamp their methods and approach to offset the arguments offered by the engine salesmen against purchased power. This type of rate has met with approval by many pipe-line engineers and executives with whom the matter has been discussed. New conditions demand new thinking.

▼

Cost of Installing Four Breakers and Related Bushing "Pots"

From the construction records of the New England Power Engineering & Service Corporation are taken the accompanying itemized costs of purchasing and installing four 800-amp., 230-kv., direct-current, motor-operated high-speed oil circuit breakers and 24 bushing type potential transformers associated with them at the Andover, N. H., switching station on the Fifteen Mile Falls-Tewksbury line.

Cost of Installing Four 230-Kv. Breakers and Bushing Potential Devices in 1930

Oil Circuit Breakers	
Labor	$4,731.27
Material and Miscellaneous	
4 800-amp., 230-kv. oil circuit breakers	180,511.00
2 Bushing storage tanks	134.00
Rental of trailer	680.00
Trucking charges	56.00
Reserve oil, 15,675 gal. No. 21 at $0.29	4,545.75
Freight on empty oil drums returned	324.54
Valves and gage glasses	7.68
Filter paper, 650 lb. at $0.19	126.00
Lumber, nails and building supplies	30.55
Wiping rags, 52 lb. at $0.16	8.32
Crosby clamps	3.00
Ten strip heaters	17.06
Thermostat	17.17
Six gaskets for bushings	42.00
Hardware	2.91
Aluminum paint, a gal.	2.60
Miscellaneous freight and express	31.50
Gasoline-barrels and miscellaneous	9.98
Hotel and traveling expense	408.06
Automobile and truck mileage	546.85
Telephone charges	1.15
4 Bryant No. 112 plug receptacles	1.19
Electrical service	3.00
Salvage on used lumber 360 f.b.m. at $20 deduct	7.20
Total	$192,234.38
Potential Transformers	
Labor	$118.25
Material and Miscellaneous	
24 bushing type potential devices for 230-kv.o.c.b.	11,600.00
Freight on two potential devices	19.38
Hotel and traveling expenses	2.67
Automobile and truck mileage	11.15
Total	$11,751.45

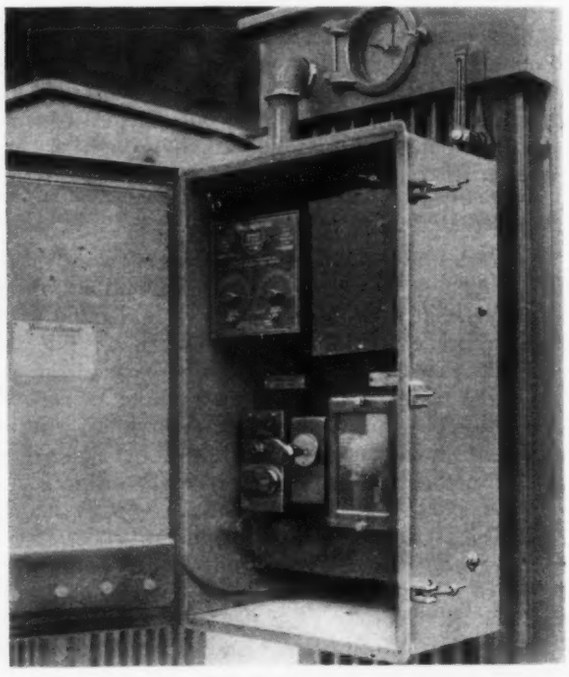
▼

Minor Changes Quiet Induction Regulators

By A. W. COPLEY

Engineering Manager
Westinghouse Electric & Manufacturing Company,
San Francisco, Calif.

At Pleasanton substation of the Pacific Gas & Electric Company three type S Westinghouse induction voltage regulators are installed within 15 to 20 ft. of a small residence. As all moving parts with the exception of the secondary relay operate under oil in this particular design these regulators are considered to be well within the limits of commercially quiet operation. However, due to the proximity of the residence, the operating company felt that good public relations demanded a complete elimination of all noise and co-operated with the manufacturer's engineers to this end.



Changes in the control cabinet contribute to the noiseless operation of this regulator

D.c. operation of the brake is made possible by the "Rectox" unit mounted on the door, the secondary relay (top, right) is incased in a sound-absorbing material which also is used to line the entire cabinet.

What little noise is noticeable in the standard regulator consists mainly of the metal-to-metal contact when the brakes set or release or when relays operate. To eliminate the former, sound-deadening material was placed on the shoes and stops of the brake mechanism and its operation changed from alternating to direct current obtained through a "Rectox" unit mounted on the door of the control cabinet and energized from the a.c. lines.

All moving parts in the control cabinet were mounted on a resilient material and the secondary relay incased in a sound-absorbing material, which was also used to line the entire control cabinet as a final precaution against noise. That these measures to insure quiet operation were completely effective is indicated by the fact that there have been no complaints since their application, it being difficult to hear any noise of operation even when standing next to the equipment.

▼

Sterilizing Packaged Cereal With Corona Discharge

With every shipping case of packaged cereal the Miller Cereal Mills, Omaha, Neb., incloses a statement:

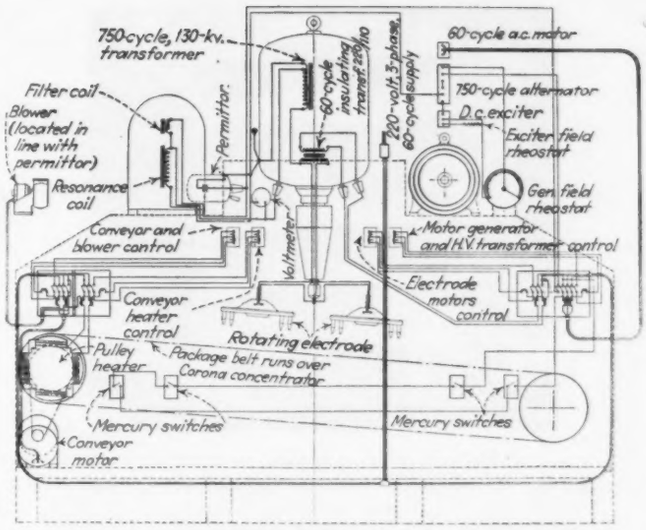
Positive practical insurance against weevil, moth, vermin of any kind, which frequently infest meal or cereals. The pests are placed on the electrical chair, so to speak, and that ends the story.

The package is passed through this Entoleter. This is a new electrical machine, recently perfected and now in use in our mill. Under its powerful electric ray every particle of insect life is killed and with deadly precision. As long as the package is unbroken the cereal will remain sound and sweet. No change in taste, color, flavor or food value

This mill has had the electric degerminator in use for upward of one year, so it has had at least one summer season to test whether there is any incubation of eggs within the packages after electrical treatment.

Three other installations of this equipment have been made recently, but while the mill managements are convinced that the treatment is effective, they will have to pass through a summer season and into the fall to obtain experience data.

The electric sterilizer is interposed in the existing packaging line and the treatment effected by passing the sealed packages through a zone of high-frequency high-potential corona, applied between two groups of rotating electrodes and a corona concentrator below the package

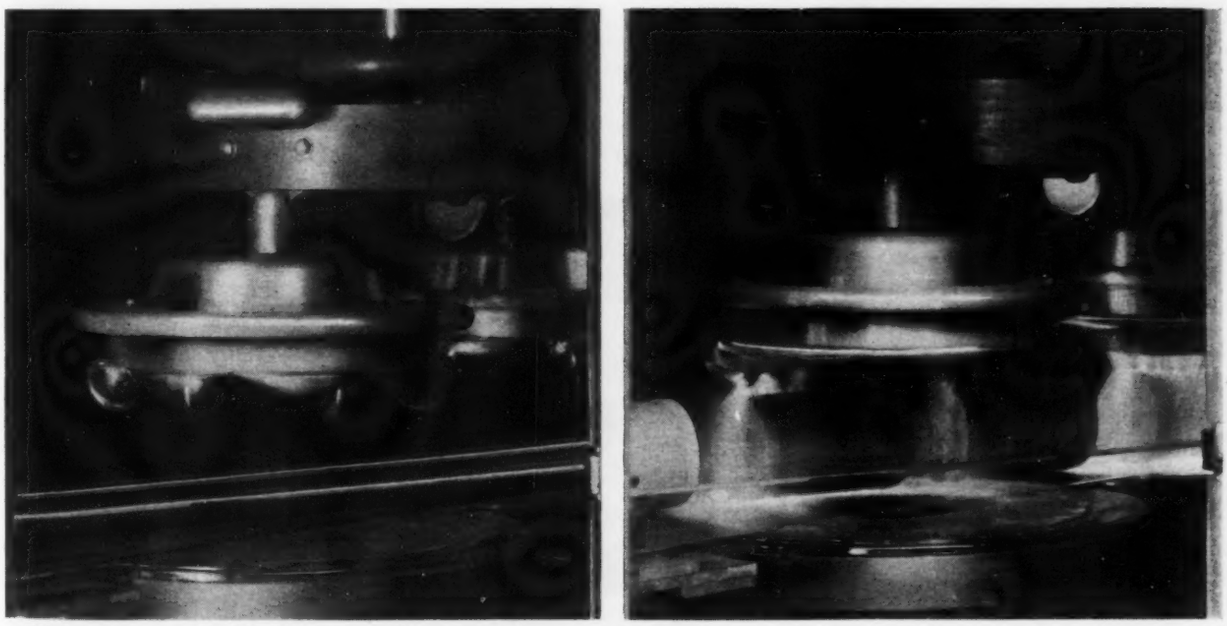


Elements of disruptive electric sterilizer

conveyor. Packaging materials and adhesives must be relatively poor electrical conductors, otherwise the material or shape of the package is immaterial as the separation of the electrodes and the intensity of the corona is readily adjustable.

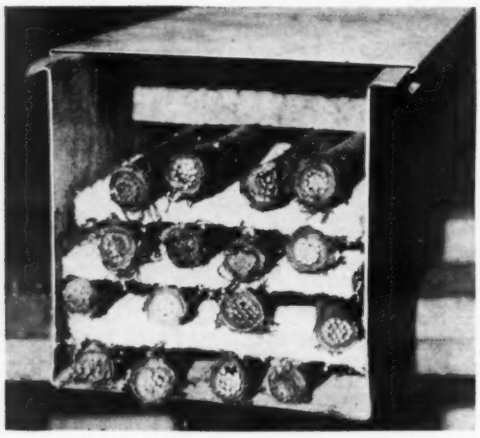
For operation commercial power is converted by a motor-generator and resonant circuit to a low-voltage, high-frequency, single-phase current and then transformed to the required voltage for the corona discharge. The high-voltage transformer is insulated and cooled by nitrogen instead of oil and all electrical apparatus is fully inclosed and dustproof.

The power demand depends on the product to be treated, the dimensions and size of the package and the rate of treatment, ranging from 4 to 7 kw., according to J. A. Dixon, vice-president Products Protection Corporation, which makes the equipment. The equipment is started and stopped by push-button control interlocked with the doors so it is impossible to generate corona unless the machine is closed for operation.



Adjustable rotating electrodes above package belt and corona concentrator prior to and during operation

Methods Used for Temporary Wiring

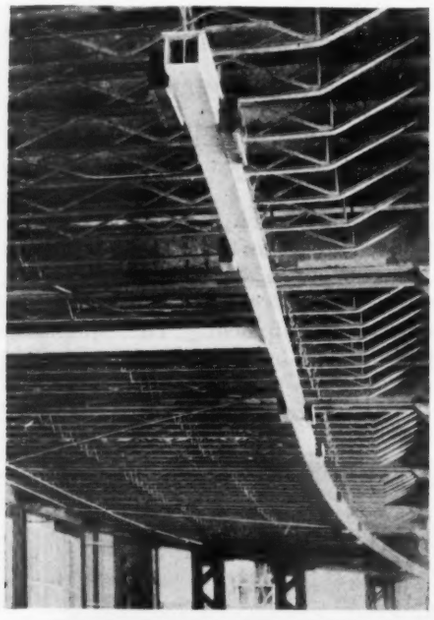


How feeders are laid in troughs

Layers of asbestos between layers of conductors. Troughs are No. 18 gage galvanized sheet metal of 5-in. square section with removable cover. They are hung from ceiling steel by bolts that pass through the bottom of the trough. The covers are snapped on the troughs in the lengths between the bolt suspensions. Incidentally, money was saved by large use of salvaged conductors for feeders. Cables insulated for 500 to 5,000 volts, even though second hand, were considered perfectly safe for 115-230 volts if care is taken to see they are in fair condition.

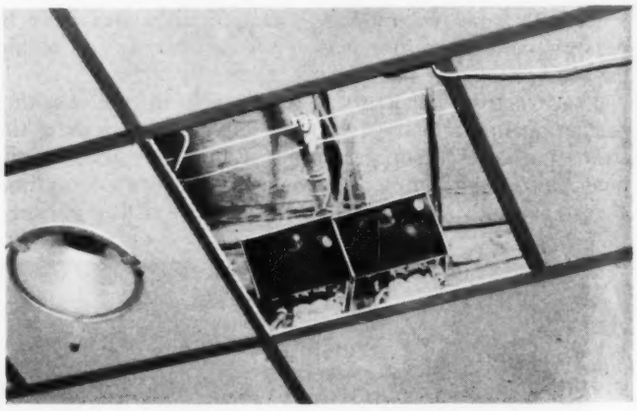
SAFETY, economy and flexibility were sought in designing the wiring system that is being installed in the buildings of Chicago's Century of Progress Exposition which will open in June this year. Work already done, the greater part of the total job, indicates how economy and flexibility were sought in the wiring design. Of course the final word on the safety of the system cannot be written until the Fair closes its gates in the fall, but extreme care has been taken to avoid hazards and the designers see no reason to anticipate that safety will not be attained. The temporary nature of the installation dictated construction that might be questioned for continued use, although it contains elements of merit even for such service.

A conspicuous feature of the wiring system is the absence of multiple circuit panels as feeder terminals. Instead, circuits are taken off as required in open wiring or conduit from fuse cut-out boxes mounted where desired on the sides of the metal troughs that carry the feeders. To as great a degree as possible wiring ma-



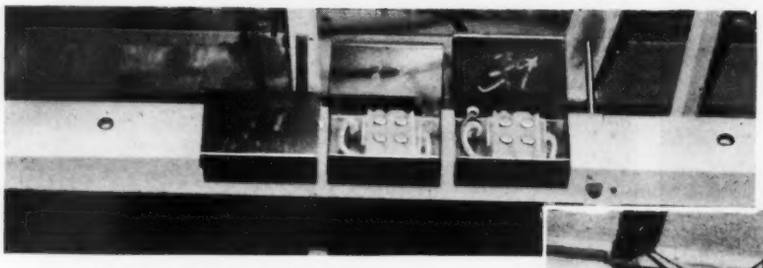
This overhead raceway is about 500 ft. long

From the left comes a feeder trough from a transformer vault. Note circuit cut - out boxes mounted on the sides of the raceway. Suspension bolt is visible in open end of raceway.



Accessibility of circuit fuses

The suspended ceiling conceals the wiring and identified panels which are removable to allow access to the cut-out boxes.

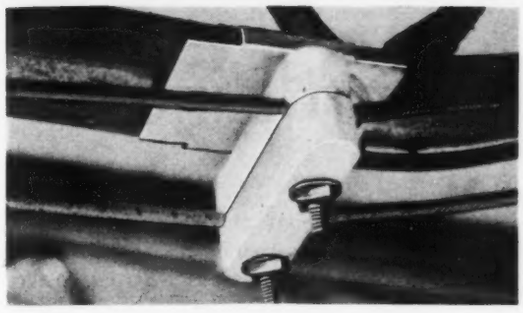


Circuit taps from feeders

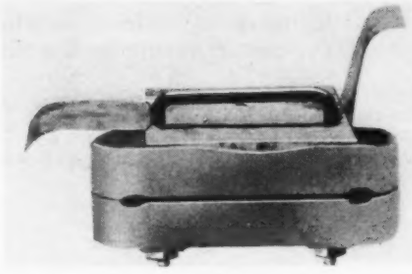
Knockout holes along the sides of the troughs allow circuit taps to be taken off anywhere.

Around obstructions

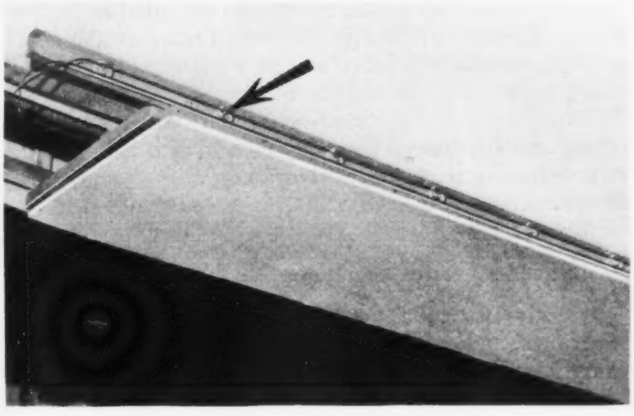
Bends and off-sets are made by angle-cutting the trough and joining the butted ends with riveted patches.



U-bolts clamp the cleats to flat pieces of metal having ears that are bent up over the flanges of building steel to hold the cleats in place.



Open wiring with preassembled cleats



For signs and strip lighting

Ten-foot lengths of No. 26 gage raceway, punched for sign sockets, are assembled at the bench. Here is a portion of a strip installed for indirect lighting in a corridor. Arrow points to one of the sockets.

terials and devices are preassembled and preshaped either by the suppliers or in shops on the ground. Field labor is thus employed essentially in installation and little time is used in assembling and cutting and fitting on the job. Details are disclosed in the accompanying pictures and captions.

▼

Ready With the Figures

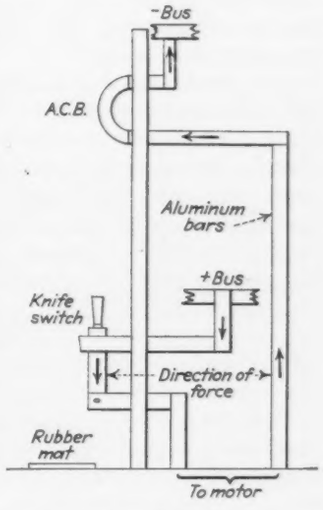
Replies have already started to flow in with data for the ELECTRICAL WORLD's annual supplement of 100,000,000-kw.-hr. systems. The record for speed goes this year to the Southern Canada Power Company, Ltd. The form, completely filled out, was received from Montreal on the second morning after mailing from the New York office of the ELECTRICAL WORLD. It shows an increase of 5 per cent in output compared with 1931. Next came Hartford—less total but 10 per cent more domestic sales—and Twin City Rapid Transit Company.

Short Circuit Opens Knife Switch

By S. EIN
Hammond, Ind.

Demonstration of the enormous potential force inherent in excessive values of current by the opening of a disconnect switch solely by means of its own developed power occurred recently in a large Middle West steel mill. In one of the rolling mills four 3,000-kw. generators are connected in parallel to feed a 600-volt d.c. bus from which six 3,500-hp. and two 600-hp. roll motors receive energy. A typical switching arrangement for one of the larger motors is shown in the accompanying diagram.

While rolling steel the commutator of a 3,500-hp. motor flashed over. The resulting short circuit caused quite a few things to happen. Among others, as stated above, the disconnect knife switch for the motor in trouble was found open and, equally surprising, two gashes, spaced the same distance apart as the outer blades of the disconnect, were found cut completely through the $\frac{3}{8}$-in. rubber mat in front of the switchboard. The motor's circuit breaker was opened by its overload device, but evidently not in time to stop the rise of current through the short circuit. For an explanation of this phenomenon the disconnect switch and the aluminum bars in the lead to the circuit breaker can be considered as two parallel conductors carrying currents flowing in opposite directions. The fields produced, being in the same direction in the space between the switch and bars, will make conductors repel each other. Since the aluminum bars are fixed in position and the disconnect is free to move, the latter will fly open when the force is sufficient, as it was in this instance.



The knife switch blew open

The damage done by the flashover was extensive. The interpole and compensating windings on the motor which started the trouble were distorted, as were some of the aluminum bars in the leads from the generators to the motors. In pumping into the short circuit, the adjacent motors generated currents large enough to cause them also to flash over, but to a smaller degree. Since each piece of equipment was forced to handle high currents, their circuit breakers opened, but in doing so many were severely burned. To prevent a recurrence of this damage series relays have been installed in the leads of each of the twelve machines to open the circuit breakers of all when any one has abnormal current flowing in the correct or reverse direction.

Reducing Cost of Farm Lines

By ERLING RINGSTAD
Assistant Distribution Engineer
Electric Bond & Share Company

FARMING districts constitute one of the largest fields for new business and this load should be developed as rapidly as is economically practicable. This is being realized to an increasing degree by the electric utilities. Most companies which published their budgets for 1932 made no curtailments whatsoever in their rural distribution program and in some cases they actually increased the amount of capital to be spent for this item.

About a year ago Electric Bond & Share Company undertook a survey of the present farm-line construction practices of its associated domestic properties for the purpose of stimulating interest in this subject and to devise means by which economies could be effected in the construction and operation of farm lines. Twenty-three operating companies were included in this survey, covering many sections of the country. The replies from these companies and supplementary studies have been carefully analyzed and certain definite conclusions have been reached as to ways and means for effecting reductions in the cost of farm-line distribution.

Present practices

The survey brought out many interesting facts regarding present practices:

Division of Investment—The investment in farm lines, comprising primaries, secondaries, transformers, service drops and meters, is in the following proportions:

	Lines		Transformers	Service Drops and Meters
	Primary	Secondary		
Average (non-weighted)	61.7	9.8	21.4	7.1
Minimum* (average of two lowest)	48.8	0	10.7	1.1
Maximum* (average of two highest)	75.4	20.6	31.7	14.9

* These figures do not total 100 per cent except in the case of average cost because averages of the two lowest and two highest percentages were used for the minimum and maximum percentages shown. — EDITORS.

From this it will be noted that primary lines constitute the greater portion of the investment and that they offer the most likely field for reduction in over-all cost.

Load Data	Number of Farms per Mile (Whether Connected or Not)	Connected Load (Kw.) per Customer
Average (non-weighted)	6.9	3.05
Minimum (average of two lowest)	3.1	0.53
Maximum (average of two highest)	12.5	6.25

In connection with the number of farms per mile it is believed that the average is somewhat higher than that of typical farm districts, as most likely the present lines to a large extent cover territories adjacent to cities and towns. It is believed that about five farms per mile would be a more representative figure as this corresponds closely with values that companies with extensive farm lines have reported. Probably still lower figures will obtain as the development progresses.

No attempts were made to ascertain the kw. or kva. demand per customer nor the diversity of such loads:

Primary Line Data

Average pole height (ft.) ..... 30 and 35
Average pole class ASA..... Nos. 3, 4, 5, 6
Average conductor..... Nos. 6 and 4 bare m.h.d. and h.d. copper

	Span Lengths (Ft.) — Designed for	
	Primary Only	Primary and Secondary
Average (non-weighted)	273	229
Minimum (average of two lowest)	213	143
Maximum (average of two highest)	300	297

A large majority of the companies included in the survey are in medium-loading districts, therefore the above data can be taken as more or less representative of lines built for medium-loading conditions.

Transformers—The number of customers per transformer installation was about one and one-half and the most common sizes of transformers were 3 and 5 kva. for primary voltages of 2,300 to 6,900 and 5 kva. for 7,630 to 13,200.

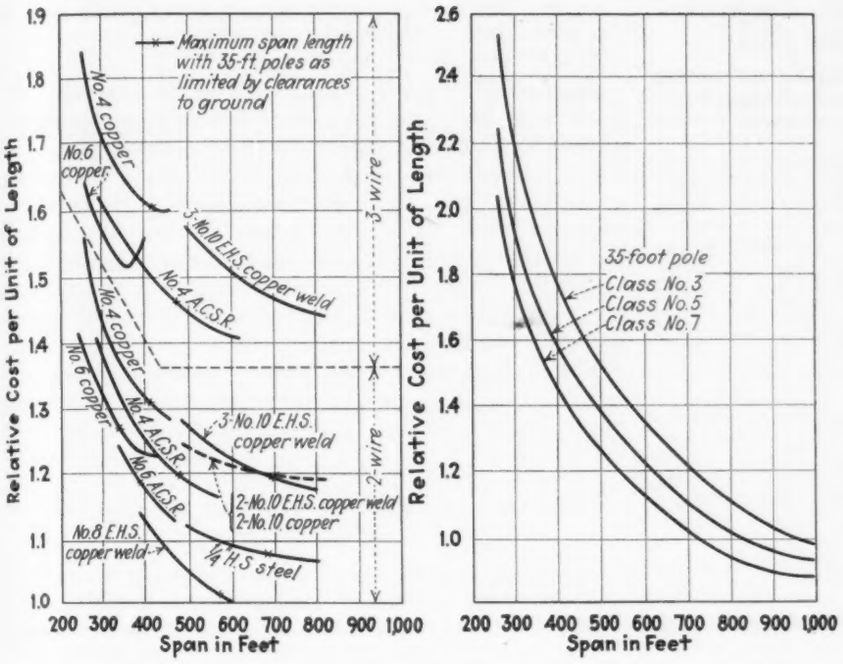
How major economies can be effected

A study based on the data obtained from operating companies and on fundamental engineering conditions brought out several paths along which to work for major economies in the construction of farm lines. These are as follows:

More Comprehensive Planning—In order to serve farm load on the most economical basis it is necessary to view this load in its entirety and not in "piecemeal" fashion, as is the tendency. Surveys should be made of the complete farm districts and all the potential loads plotted on convenient-sized maps which will serve as a basis for the layout of lines and all future load-building programs. Service requirements should be ascertained as well as the type of distribution system and construction which will meet these requirements at minimum cost.

Some years ago the Idaho Power Company undertook to serve large farm districts and developed a program which was described in the ELECTRICAL WORLD of December 28, 1929. That this well-thought-out planning has been very beneficial is shown by the present relatively low investment costs of the farm lines of this company.

Higher Primary Voltage—A moderately high primary distribution voltage (such as 13.2 kv.) should be adopted for farm line distribution, particularly where a transformation can be eliminated thereby. The higher primary voltage will result in lower cost primary lines and will greatly lower the investment in substations. It will also assure much better voltage regulation at customers'



Figs. 1 and 2—Effect of span length on unit cost

Based on two-wire, 7.2-13-2-kv. pole lines exclusive of conductors. The poles considered are yellow pine (8-lb. empty cell creosote treated). Cost includes right-of-way, clearing, poles, insulators, crossarms, labor and 10 per cent overhead expense. No. 6 A.C.S.R. is equivalent to No. 8 copper in conductivity and No. 4 A.C.S.R. is equivalent to No. 6 copper.

premises, which is of great importance from a load-building and customers' relations standpoint.

Increased Span Length—Increasing the span length* appears to be the most effective change in physical design available for decreasing the cost of farm lines at the present time (see Fig. 1).

Build Primary Lines for Primary Conductors Only—The survey indicated that about 65 per cent of all the primary lines were built for both primary and secondary conductors, while actually only a very small percentage of the primary lines carried secondary conductors.

Since the cost of a light-capacity pole line designed to carry both primary and secondary conductors is materially higher than one designed to carry primary conductors only, it follows that a large saving can be effected by designing and constructing light primary lines, other than the sections initially requiring secondaries, for primary conductors only. When secondaries are required the required additional strength and clearance can be provided by means of intermediate poles.

Eliminate Excessive Pole Strength—From Fig. 2 it will be noted that the difference in cost of a line with, say, class No. 3 poles and class No. 7 poles is an appreciable item. The studies indicated that most light primary single-phase lines can be built with class No. 7 poles and still have an adequate factor of safety.

Eliminates Costly Transformer Accessories—Twenty to 30 per cent of the total cost of transformer installations is chargeable to the primary fuses and lightning arresters. This large investment in accessories is of questionable economic value for many rural situations. For example, simple spillway gaps should give adequate protection to the transformer against damages from lightning, although flashover of such gaps would mean momentary service interruption.

Primary fuses can probably be eliminated on many rural lines without materially affecting continuity of service. For some situations where continuity of service would be materially impaired by the elimination of arresters and/or primary fuses other expedients are available which would solve the difficulty at lower cost. For example, automatic reclosing sectionalizing devices, such as repeater fuses, could undoubtedly be used to advantage in many cases for branch lines and sections of main lines. Secondary fuses could be used to isolate secondary faults.

Important design factors

Most manufacturers have now developed self-protective type transformers having bushing flashover coordinated with insulation strength and it is believed that for all new installations these transformers will be preferable to the type having pocket type bushings.

*See panel [EDITORS].

Removing the Obstacles to Long-Span Construction

In sections of the country where the roads have frequent curves, or even on straight roads where there are many trees, long spans may not be possible or practical and provision must be made for frequent angle construction—a combination which greatly increases the unit cost. Furthermore, it may not be possible to maintain long-span construction where the terrain is rolling or where the spacing of customers does not conform fairly closely with long-span pole positions.

In fact, some companies which have designs for long-span construction are unable to maintain a long average span because of these and other local conditions.

Some companies have avoided excessive angle construction and other deterrents to long-span construction by building their primary lines on straight private right-of-way back of the farm houses, unencumbered by trees or causes for "overbuilds." While it might appear that such lines would be less accessible for maintenance than lines on highways, some companies have found that they are less susceptible to mechanical injury from falling trees, branches, etc., and do not have to be shifted when roads are widened or straightened, so less maintenance is necessary. Furthermore, the limitations to erection and use on highways, such as securing state, county, township approval, paying a local authority for required supervision of tree trimming, and many other inhibitions that cause delay or raise cost are avoided, although the practice may not be the solution in all cases—(EDITORS).

Table I—Proposed Tension of Small-Size Conductors of Various Types of Materials

These limiting tension values are intended for conductors of 25,000 to 75,000 circ.mils. For mixed strand copper and bronze and copper and copperweld the 30,000 lb. limitation applies to one strand of copper and two strands of bronze or copperweld.

	Limiting Tensions					
	Light Loading		Medium Loading		Heavy Loading	
Type Conductor	Per Cent of Ultimate Strength at Max. Loading	Not to Exceed Following Lb. Sq.In. at 60° No Wind	Per Cent of Ultimate Strength at Max. Loading	Not to Exceed Following Lb. Sq.In. at 60° No Wind	Per Cent of Ultimate Strength at Max. Loading	Not to Exceed Following Lb. Sq.In. at 60° No Wind
Copper.....	50	†20,000	†50	20,000	†50	20,000
Hitensile bronze.	40	†38,000	50	†38,000	†60	38,000
Copperweld 30 per cent H.S...	40	†30,000	50	†30,000	60	†30,000
Copperweld 30 per cent E.H.S.	40	†38,000	50	†38,000	60	†38,000
Steel (S. M.)....	40	†20,000	†50	20,000	†60	20,000
Steel (H. S.)....	40	†35,000	50	†35,000	†60	35,000
Steel (E. H. S.)..	35	†45,000	50	†45,000	60	†45,000
Copper and bronze.....	40	†30,000	†50	30,000	†55	30,000
Copper and E. H. S. copperweld.....	40	†30,000	50	†30,000	†55	30,000
A.C.S.R. (with armor rods)...	50	.....	60	.....	70	.....

† This will probably be the limiting tension.

Certain technical features and some of the more important limiting factors that should be taken into account to secure low-cost farm line design follow:

Right-of-Way—Farm lines are generally built along the roadside and as a rule the expense for right-of-way is negligible. However, there are situations where expensive tree trimming is encountered and in some districts the roads are rather crooked and later changes in the locations of the roads sometimes necessitate relocating the pole line.

In view of these factors many companies have found it advisable to locate pole lines on private right-of-way where such handicaps exist.* It is suggested that every problem involving location of pole lines should be decided upon its own merits rather than adopting the fixed policy of building all farm lines on the highways.

Clearance to Ground—The National Electrical Safety Code is a generally accepted guide to safe practice. But in applying the rules of this code it should be noted that they were generally set up for copper conductors and short spans. With small-size high-strength conductors and long spans the clearance to ground with ice loading should be carefully considered. It is suggested that the following guiding principles be applied:

Clearance above ground as given in Table I of the Safety Code should be provided under normal condition where lines follow the roads. In this case ice loading should not be considered as a normal condition, although maximum temperature should be so considered. The clearance under ice loading should be based on good judgment depending upon local conditions.

At crossings over railroads, telephone lines, highways, roads and farm lines the clearance under conditions of maximum assumed ice loading and maximum assumed temperature should be fully taken into account.

Over private right-of-way safe clearance can only be determined by judgment and experience, taking about 18 ft. at 120 deg. as a minimum. Allowance should be made for use of the usual farm machinery, irregular ground, fences, walls, etc. In this case clearance to ground under maximum ice load would usually not be of great importance.

Mechanical Factors of Safety—It is generally the practice in designing mechanical structures to decide on a definite factor of safety for an assumed maximum loading condition. For distribution line work such academic design is not always followed. However, in order to attain the object of building low-cost lines it seems necessary to set certain allowable factors of safety, especially for the poles, as it is undoubtedly true that many companies now build their farm lines with excessive pole strength.

For average wood poles having a reasonably long life expectancy, either due to preservative treatment or other conditions, a reasonable factor of safety would be about

Table II—Characteristics of Conductors Available for Rural Lines

Breaking strength of stranded wire = 90 per cent of the sum of individual strands

Type Conductor	Area Sq.In.	Ohms per 1,000 Ft. 20 Deg. C.	Per Cent Cond. Copper Basis	Weight per 1,000 Ft.	Breaking Strength, Lb.
No. 6 H.D. solid copper.....	0.0206	0.406	97.3	79.5	1,280
No. 4 H.D. solid copper.....	0.0328	0.255	97.3	126.4	1,970
¼ in. 7-strand S.M. steel.....	0.0352	2.345	9.5	121.0	3,150
5/16 in. 7-strand S.M. steel...	0.0595	1.380	9.5	205.0	5,350
⅜ in. 7-strand S.M. steel.....	0.0792	1.035	9.5	273.0	6,950
¼ in. 7-strand H.S. steel.....	0.0352	2.396	9.5	121.0	4,750
5/16 in. 7-strand H.S. steel...	0.0595	1.485	9.5	205.0	8,000
¼ in. 7-strand E.H.S. steel....	0.0352	2.445	9.5	121.0	6,650
No. 6 A.C.S.R. (equiv. No. 8 cu.).....	0.0206AL	0.648	61.0	36.4	1,045
No. 4 A.C.S.R. (equiv. No. 6 cu.).....	0.0328AL	0.408	61.0	57.9	1,565
No. 8 Sol. 30% E.H.S. copperweld.....	0.0129	2.153	29.25	45.5	2,190
3 No. 10 30% H.S. copperweld	0.0245	1.139	29.25	87.0	3,320
3 No. 8 30% H.S. copperweld	0.0386	0.723	29.25	138.0	4,860
3 No. 6 30% H.S. copperweld	0.0618	0.452	29.25	220.0	7,230
3 No. 10 30% E.H.S. copperweld.....	0.0245	1.139	29.25	87.0	3,930
3 No. 8 30% E.H.S. copperweld.....	0.0386	0.723	29.25	138.0	5,900
3 No. 6 30% E.H.S. copperweld.....	0.0618	0.452	29.25	220.0	8,750
1 No. 10 Cu. 2 No. 10 E.H.S. copperweld.....	0.0245	0.642	51.93	89.2	3,100
2 No. 10 Cu. 1 No. 10 E.H.S. copperweld.....	0.0245	0.445	74.61	91.8	2,210
1 No. 8 Cu. 2 No. 8 E.H.S. copperweld.....	0.0386	0.407	51.93	142.0	4,640
No. 8 Cu. 1 No. 8 E.H.S. copperweld.....	0.0386	0.283	74.61	146.0	3,380
1 No. 6 Cu. 2 No. 6 E.H.S. copperweld.....	0.0618	0.254	51.93	226.0	6,970
2 No. 6 Cu. 1 No. 6 E.H.S. copperweld.....	0.0618	0.177	74.61	232.5	5,090
3 No. 10 Calsum bronze.....	0.0245	2.220	15.00	91.5	2,930
3 No. 8 Calsum bronze.....	0.0386	1.410	15.00	145.5	4,580
3 No. 6 Calsum bronze.....	0.0618	0.880	15.00	231.2	7,110
1 No. 10 Cu. 2 No. 10 Calsum bronze.....	0.0245	0.784	42.50	93.0	2,390
2 No. 10 Cu. 1 No. 10 Calsum bronze.....	0.0245	0.475	69.90	94.0	1,910
1 No. 8 Cu. 2 No. 8 Calsum bronze.....	0.0386	0.494	42.50	147.5	3,720
2 No. 8 Cu. 1 No. 8 Calsum bronze.....	0.0386	0.300	69.90	149.5	2,980
1 No. 6 Cu. 2 No. 6 Calsum bronze.....	0.0618	0.330	42.50	234.4	5,790
2 No. 6 Cu. 1 No. 6 Calsum bronze.....	0.0618	0.189	69.90	237.6	4,620

**See panel* [EDITORS].

two at the time of installation. For conductors the factor of safety in general should be such that the elastic limit of the material will not be exceeded during the maximum loading conditions. This means that the tension of the conductor at maximum loading condition should not exceed 50 to 70 per cent of the breaking tension, this spread being accounted for by the variation in the elastic limit as between the various materials. However, the allowable tension cannot be considered from this standpoint alone, since there is a possibility of breakage of high-strength conductors from vibration if the tension is too high under normal conditions, say 60 deg. F.

Therefore, it is necessary to set another limit in tension for the 60-deg. F. condition. The various limiting tensions that are tentatively recommended in Table I were arrived at with a very limited amount of data. Thus far the influence of some factors is indefinite, such as diameter, stranding, modulus of elasticity, etc., although as far as stranding is concerned there are some indications that a three-strand conductor is less subject to vibration than a solid conductor. It is expected that further operating experience, together with the results of manufacturer's field tests, will modify the limiting values given in this table.

There is a difference in the meaning of ultimate strength as applied to poles and conductors. This is due to the way in which they are generally tested. Poles are tested as a beam and the ultimate strength of the wood computed from a formula, while for conductors the ultimate strength is determined from a direct tension test. Consequently a pole may be loaded close to the breaking point and if the load is then decreased the pole will not have suffered any appreciable permanent injury from such load duty. For conductors, however, if we exceed the elastic limit the wire will stretch and a permanent elongation will be effected, perhaps making it necessary to resag the conductors.

It is also found that while the ultimate strength of a wire is a fairly definite figure for any given size of material, the ultimate strength of a wood pole is very erratic, varying over 100 per cent under apparently identical conditions. The accepted ultimate strength for poles is necessarily based on the average minimum. These facts should be kept in mind when specifying factors of safety.

Poles—Studies indicate that span lengths requiring poles above 35 ft. in length do not materially decrease the cost of a primary line as the increased cost of the higher pole offsets the saving of increased span length. With a 35-ft. pole the maximum allowable sag with 18 ft. clearance to ground will be about 10 ft. The average span length will, of course, vary with the different types of conductor material. This will be discussed later.

Whatever type of pole is used, it is essential that consideration be not confined to existing types and sizes normally carried in the power company's pole yard, but that full consideration be given to all the various kinds available in the open market.

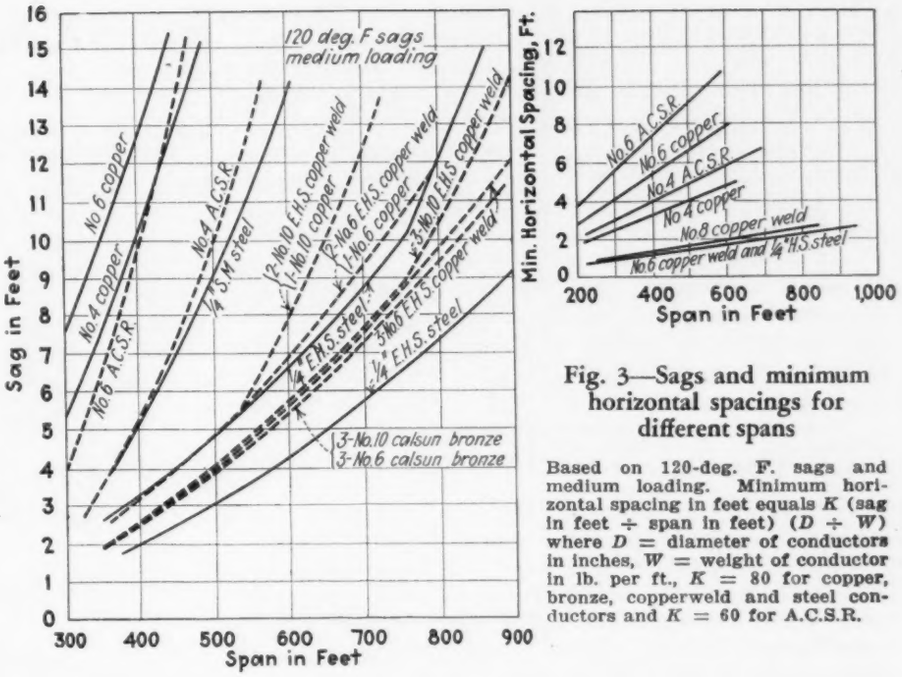


Fig. 3—Sags and minimum horizontal spacings for different spans

Based on 120-deg. F. sags and medium loading. Minimum horizontal spacing in feet equals K (sag in feet ÷ span in feet) (D ÷ W) where D = diameter of conductors in inches, W = weight of conductor in lb. per ft., K = 80 for copper, bronze, copperweld and steel conductors and K = 60 for A.C.S.R.

Conductors—There are various types of conductor material now available that should be considered for farm line construction (Table II). In general, it can be said that where good conductivity is essential, due to heavy load or long distances, copper conductors at present-day market prices will result in fairly low over-all cost values as compared with high-strength material, except that A.C.S.R. for some conditions shows still lower initial cost than copper. However, for most farm lines where the primary voltage is reasonably high, conductivity is not of primary importance, at least for the branch lines, and these will probably constitute 60 to 75 per cent of the total primary line mileage. For such conditions high-strength conductors, such as copperweld, high-strength bronze and steel, will give lower over-all cost than copper, due to permitting the use of longer spans.

All conductor materials have certain inherent advantages and disadvantages that also should be given some weight. For the sake of brevity, these advantages and disadvantages will not be given in this article. It is expected that one or two manufacturers will soon bring out types of conductor materials that will be still more suitable for farm line construction from the standpoint of mechanical and electrical characteristics and cost.

Span Length, Sags, Tensions and Horizontal Clearances—Increase in span length* is one of the most effective direct means for decreasing the cost of farm lines. Long span lengths are particularly advantageous for single-phase lines where secondary conductors may have to be installed at a later date, since the additional pole strength required for the secondary conductors need not be provided in the line at the time of installation of the primary, but can be provided at the time of installation of the secondaries by adding intermediate poles.

*See *panel* [EDITORS].

This latter practice also has the advantage that the additional clearance to ground required when secondaries are installed will also be provided, since by reducing the span length to one-half, the sag in the primary conductors will be reduced to one-quarter of the former value.

Increase in span length, however, introduces certain limitations that should be carefully considered. One is that, unless midspan spreaders or other special construction are used, the horizontal spacing between conductors will have to be materially increased. This limiting feature is of especial significance with three-phase lines in heavy loading districts, with low-strength conductors such as copper, and with conductors having low specific gravity such as A.C.S.R. However, where this feature tends to place a limit on the span length, the use of some simple form of midspan spreader or, in the case of three-phase lines, a vertical offset of the middle conductor may be used.

The proposed minimum horizontal spacing for medium-loading conditions for various types of conductors and span lengths is shown in Fig. 3. This also gives the formula used for determining these spacings, proposed by Percy H. Thomas† for use in high-voltage transmission. Values of the constant K were derived from a very limited amount of data, therefore due consideration should be given to experience in any particular locality. The formula states that the tendency for conductors to swing together increases with the per cent sag and with the diameter, but decreases with the weight per foot, or, another way of saying the same thing, that it increases with the span and diameter but decreases with the tension.

As stated previously, another limitation to be considered in connection with long-span farm lines is vibration trouble. Judging by the experience obtained with transmission lines, such trouble is liable to occur under certain conditions. It appears that conductors under high tension are more likely to vibrate than if sagged to a lower tension, also that fatigue failures develop rapidly in very tight wires. It is, therefore, concluded that conductors must be sagged so as to not exceed some critical value at normal temperature, as previously discussed.

Conductor Configuration—Horizontal configuration of the conductors, using 6-, 8- or 10-ft. crossarms, is, in general, more advantageous than other types of configuration. There are some exceptions, particularly in the case of single-phase lines with one conductor grounded.

In summarizing, it is believed that material savings can be effected in the cost of farm lines by the following methods:

1. More comprehensive engineering planning.

2. Use of higher primary voltages, of, say, 13.2 kv.

3. Increased span length.

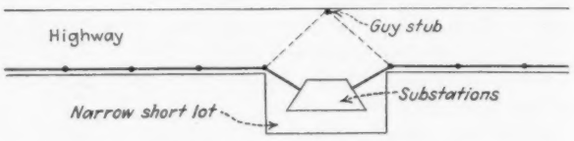
4. Build primary lines for primary conductors only where the secondaries are not required initially.

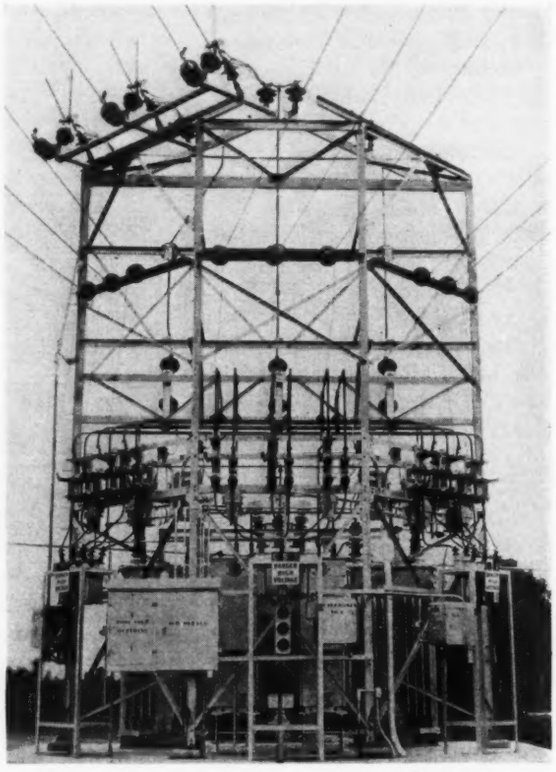
5. Eliminate excessive pole strength.

6. Reduce costly transformer accessories.

†*See A.I.E.E. Proceedings, 1930.*

In-and-Out Substation





Conventional ideas of design and layout do not characterize this substation built by Wisconsin Gas & Electric Company (Racine). Most engineers think of substations as rectangular structures simply because that is how most engineers think of them. But must a substation be rectangular? The Wisconsin engineers decided to try another shape. It is shown in the accompanying plan and picture. As is apparent, the substation requires no pole construction outside the line of the transmission lead. The only additional line construction is a couple of side guys to take the pull of the conductors running into the substation.

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Controlling Tank Current in Copper Works

By W. C. NODDINGS
Chief Electrician
Raritan Copper Works, Perth Amboy, N. J.

At the Raritan Copper Works we have a rotary converter on a tank circuit whose direct current is kept constant within certain limits by means of a set of relays, operated from contacts actuated by the movable element of a graphic ammeter. These relays, in turn, operate a

voltage regulator intermittently, thus varying the voltage at the a.c. rings of the rotary, until the meter again reaches a normal reading, thereby stopping further relay action.

These relays thus automatically opened and closed two or three times whenever a slight adjustment of the load was necessary and it was important that the timing be just right to allow the meter time to respond to the changes made. If the relays were too fast there would be hunting at the meter and a continual operation of the relays. It was found that proper operation of one relay was the key to the success of the whole operation. If this relay went in and out about once a second the meter had time to follow the change and stop the operation of the relays as soon as the load was again normal. The problem then was somehow to give this relay a dependable time-delay action of about one second.

The relay manufacturer evidently depended upon the residual magnetism of the relay core to accomplish this as there was a set screw in the face of the armature to allow for adjustment. But this means of adjusting was found to be very critical and impermanent. Different cores were tried without success until it was found that a safety razor blade "did the trick." By suspending this razor blade between the armature and the steel core there was still enough residual magnetism action left to delay the relay dropping out and, best of all, the relay never failed to drop out.

The steel in the razor blade delayed the relay dropping out for just about a second. In this manner a reliable time-delay action was secured for this relay. The razor blades were hammered by the armature a good many times a day and would break off about every three weeks, but it was a simple and cheap matter to insert a new one.

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READERS' FORUM

Would Relegate Spark Gaps to Past

To the Editor of the ELECTRICAL WORLD:

Some 30 or 40 years ago, when transmission of power was first beginning, spark gaps were introduced for lightning protection. The limitations of such gaps were early recognized and they were soon discarded.

In spite of this early experience, however, some engineers have reintroduced the spark gap, first, under the guise of a co-ordinating gap and, finally, as an out-and-out protective device. However, the authors of the group of papers on insulation co-ordination at the recent A.I.E.E. convention now admit that as a protective device the plain spark gap is a failure and must be supplemented by covered sphere gaps, capacitors, resistors, etc. The expense of such devices becomes considerable and in order to give protection the gap must flash over, thereby causing a possible trip-out and at the same time impressing a steep tail wave on the apparatus.

The time is now opportune to suggest a more rational scheme of co-ordination and protection:

At the present time the strength of apparatus insulation and normal operating voltage are related by the A.I.E.E. 60-cycle high-potential test of two times rated r.m.s. line-to-line voltage plus 1,000 volts for transformers and similar apparatus and 2¼ times rated r.m.s. line-to-line voltage plus 2,000 volts for oil circuit breakers and other protective apparatus. A factor of safety above the test values is provided in the apparatus by the designer.

Undoubtedly, corresponding relations between impulse strength of apparatus and normal operating voltage or high-potential test will be a future requirement. Such relations can be agreed upon mutually by representatives of the utilities and the manufacturers, taking into account the various types and uses of apparatus and the cost of procuring the desired strength.

Let us consider for the sake of discussion that a ratio of two, based on a 1/5 wave of positive polarity, is assumed as reasonable between the crest value of the impulse test and crest value of the 60-cycle high-potential test for all apparatus such as transformers, oil circuit breakers, bus insulators and other apparatus which form component parts of high-voltage stations. Based on 1½/40 wave, the ratio would be correspondingly reduced, say to 1.25. Oil circuit breakers and allied apparatus would rationally receive the same tests as transformers and similar apparatus, since they are exposed to the same over-voltages.

Now, it is only necessary for the manufacturer to design his apparatus to meet a specified standard impulse test and for the utility to limit the voltage that can reach the apparatus to a value below the test value. Such limitation of voltage is preferably accomplished by means of lightning arresters. The modern arrester is safe, efficient and economical and will limit the voltage to the desired value without interruption to the service and without impressing an abrupt wave tail on the apparatus. For the types of apparatus under consideration, the limitation by an arrester to, say, 75 to 85 per cent of the impulse test would probably be ample. The arresters would preferably be installed at the junction of the incoming lines and station.

As a further part of the proposed scheme, the station would be protected from direct strokes by a network of overhead ground wires connected to the low-resistance station ground, and all the incoming lines would be similarly protected for 2,000 ft. to 3,000 ft. from the station. With this arrangement, practically all of the lightning surges that would come to the station would be in the form of traveling waves with more or less sloping fronts.

The proposed impulse tests would take the place of the elaborate, inconclusive and impractical set of tests suggested in the A.I.E.E. paper "Progress Report on Impulse Testing of Commercial Transformers," by Messrs. Vogel and Montsinger. The spark gap would disappear from the picture and be relegated to the position of obscurity which it has occupied for the past 30 or 40 years.

Generators and other low-tension apparatus may require special treatment, such as suggested in the paper on "Protection of Rotating Alternating-Current Machines Against Traveling Wave Voltages," presented at the same session as the co-ordination papers.

W. W. LEWIS.

General Electric Company,
Schenectady, N. Y.

Men of the Industry

MARSHALL FIELD, III, New York capitalist, has recently been elected to the board of directors of the Westinghouse Electric & Manufacturing Company.

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B. J. PRICE, who for the past fifteen years has been general counsel for the Iowa Public Service Company, and associated with the Sioux City (Iowa) Gas & Electric Company the past four weeks, during negotiations which resulted in readjustment of gas and electricity rates, has been elected president of the Sioux City utilities, succeeding W. J. Bertke, resigned. GEORGE NEAL of Sioux City, vice-president of Iowa Public Service for the past four years and acting manager since June, was elected vice-president and general manager and will be in actual charge of the company. Mr. Price maintains his law office in Fort Dodge.

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JOHN R. HEWETT, editor of the *General Electric Review* for nearly twenty years, has retired because of ill health. Born in England, he received his degree in electrical engineering from Finsbury in 1902. As a special correspondent for the magazine *Engineering*, of London, he came to this country to attend the St. Louis Exposition in 1904. After the exposition he went with the General Electric Company, in the publicity and transportation departments, and in 1913 was made editor of the *Review*.

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OBITUARY

W. H. Blood, Jr.

W. H. Blood, Jr., vice-president of the Stone & Webster Engineering Corporation, head of its appraisal division and one of the leading authorities in the electrical industry upon valuation, fire protection and safety engineering, died from a heart attack early Monday, February 13, at the Hotel Miles Standish, Boston, where he had been spending the evening with his wife and friends. He was born in Boston 67 years ago, was educated at the Massachusetts Institute of Technology and in 1888 joined the Thomson-Houston Electric Company at Lynn, Mass., where he was engaged in apparatus construction until 1890, when he went to St. Paul, Minn., to establish the repair department of the northwestern branch of the T-H organization. From 1891 to 1894 he was a partner in the contracting and jobbing house of the Franklin Electric Company, Kansas City, and during this period built some thirty small central station and electric railway properties. He went to Boston and joined the staff of Stone & Webster in the latter year, soon being assigned to construction and operating duties and to reports on utility developments. At the height of his career he traveled some 30,000 miles a year in all parts of the continent in almost every phase of the firm's business. In 1905-06 he was president of the National Electric Light Association and in 1911-12 was the first president of the then Electric Vehicle Association of America. For more than a decade he was chairman of the grounding committee of the National Fire Protection Association, insurance expert of the

N.E.L.A., and was a pioneer in the grounding of transformer secondaries. Under his direction some $7,000,000,000 worth of utility plants have been appraised. A biographical appreciation of the career of this distinguished engineer was published in the ELECTRICAL WORLD, August 19, 1922, page 360. He was a fellow of the American Institute of Electrical Engineers and a lecturer at the Harvard Graduate School of Business Administration.

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ROY L. PETERMAN, vice-president of the Southern Public Utilities Company, Charlotte, N. C., died suddenly, February 11, at his home in that city in his forty-eighth year. In addition to holding this executive position with Southern Public Utilities, Mr. Peterman had served as an officer of other utility companies in the South, including the Broad River Power Company and North Carolina Public Service Company. He had lived in Charlotte for five years, going there from Columbia, S. C., where he had been employed by W. S. Barstow & Company.

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John D. Ryan

John D. Ryan, president of the Montana Power Company and chairman of the board of directors of the Anaconda Copper Mining Company, died February 11, of heart disease, at his home in New York. He was 69 years of age. Although Mr. Ryan's most distinguished services were undoubtedly to the copper industry, his business activities embraced the public utility industry, banking and railroading. The creation of the Montana Power Company was one of his greatest achievements, bringing about one of the first railroad electrifications of the country—440 miles of the St. Paul Railroad over the Rockies. Montana Power Company supplied the current for the railroad, for virtually all the mines of the state and most of the electricity for domestic use. Some years ago, testifying before a congressional committee, Mr. Ryan admitted the company was a monopoly, stating: "It takes 95 per cent of the business and it has a monopoly not of the water-power resources of the state but of the market, and is a monopoly because its service is so good and charges so low that there is no possibility of competition."

Mr. Ryan at the time of his death was a member of the board of directors of the National City Bank, the American Brass Company, the American Power & Light Company and the Postal Telegraph & Cable Corporation. He was also a trustee of the Consolidated Gas Company of New York.

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CHARLES E. PATTERSON, formerly vice-president of the General Electric Company and president of the General Electric Supply Corporation, who retired from active business a few years ago, died at St. Petersburg, Fla., February 12 after an illness of several months. In 1901, when assistant comptroller of the New York Central Railroad, Mr. Patterson was elected comptroller of the American Locomotive Company. After eight years with that company he became associated with the General Electric Company, and in 1913 was elected comptroller. Mr. Patterson was elected a vice-president of the company in 1920. While occupying the office of comptroller of the General Electric organization Mr. Patterson was appointed chairman of the standing committee of the Electrical Manufacturers' Council, which evolved a standard accounting and cost system for the electrical industry that received the approval of the Federal Trade Commission.